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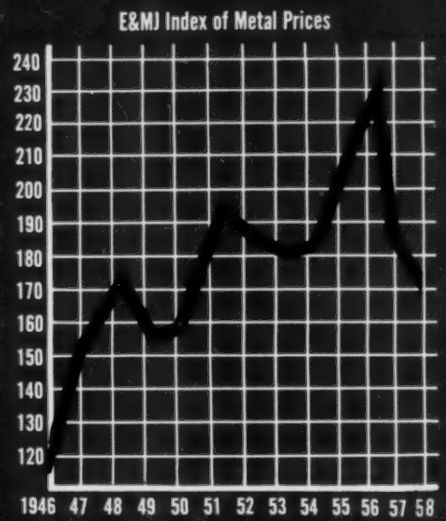


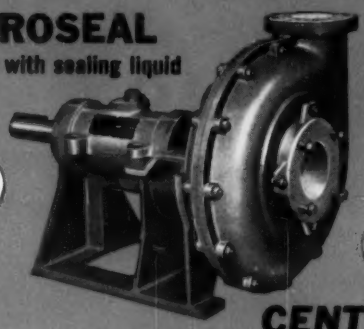
90TH Annual Survey And Outlook

GOLD
SILVER
COPPER
LEAD
ZINC
ALUMINUM
URANIUM
IRON ORE & STEEL
MAGNESIUM
TITANIUM
TIN
MERCURY
LITHIUM
BERYLLIUM
BORON
SEMI-CONDUCTORS
COLUMBIUM-TANTALUM
ZIRCONIUM
ANTIMONY
CADMIUM
BISMUTH
PLATINUM
THORIUM
RARE EARTHS
NICKEL
COBALT
MANGANESE
CHROMIUM
TUNGSTEN
MOLYBDENUM
SULPHUR
PHOSPHATE
ASBESTOS
VERMICULITE
VANADIUM
GYPSUM
BARITE
FLUORSPAR
FELDSPAR
MICA
POTASH
MINING PRACTICE
METAL & MINERAL PROCESSING
MINES, MILLS & SMELTERS

Engineered pumping of abrasives corrosives acids

INTERCHANGEABLE

HYDROSEAL
operates with sealing liquid



Split-Shell SLURRY and SAND Type
2" to 14"

Brochure No. 457

Brochure No. 557

CENTRISEAL
delivers the pulp undiluted

PACKLESS Pumps

No stuffing box
No packing
No mechanical seal
No liquid seal
No exposed metal parts

Capacity range: 25 to 800 GPM

Brochure No. 857

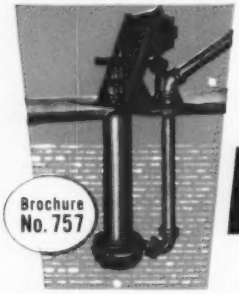
Flex-Check Valves
RUBBER-LINED

For pipe diameters up to 12"
For solids up to ¼"

Brochure No. 957

RUBBER-LINED PUMPS

HYDROSEAL
VERTICAL
sump pump



Brochure No. 757

RUBBER-LINED or ALL-METAL
Four sizes: 1½" to 6"
Slurry, Sand & Dredge

METAL PUMPS

HYDROSEAL SAND and DREDGE Type

Capacities up to 14,000 GPM
Efficiency up to 75%
1½" to 14"

Brochure No. 657

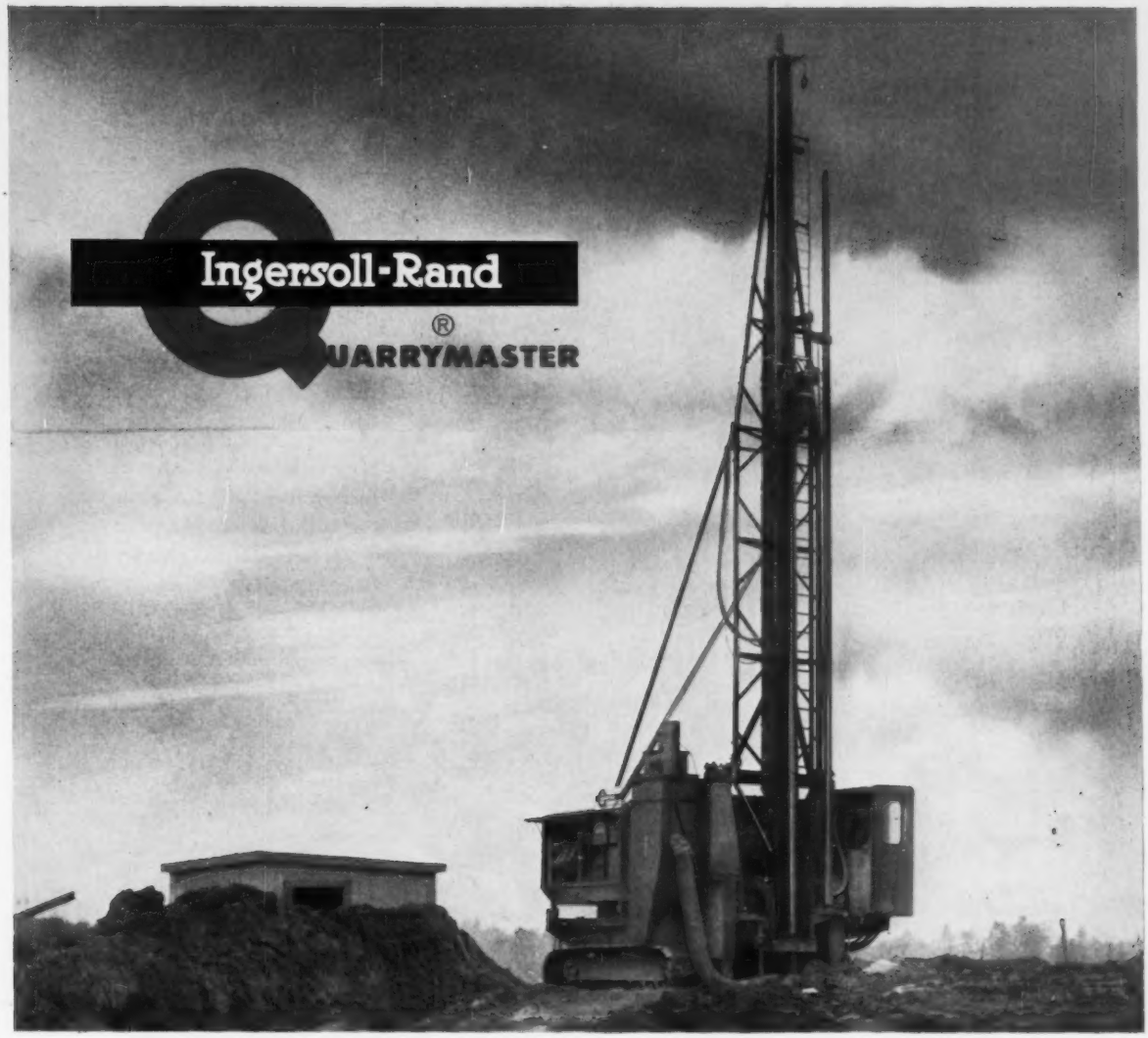
Brochure No. 357

To have an easy key to the correct type and size of pump, write us for "Technical Data" Brochure No. 357. For information in the category of your need, use the specified number. In the refinements of application, our engineers can help you.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

ASH

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED



"DOWN THE HOLE DRILL" PERFORMANCE

Results in Two Repeat Orders

An Ingersoll-Rand Quarrymaster in Quebec, Canada, is now at work drilling the extremely hard and abrasive quartzite cap rock formation overlying an extensive magnetite iron ore body. This machine utilizing an I-R DHD-400 "down the hole drill" and 7 inch Carset bits has averaged 15 to 20 feet of hole per hour since the unit went into operation last spring.

Test holes in the Magnetite iron ore indicate that overall drilling speed in the ore will be twice that in the cap rock. In the ore body the face height will be 25 feet.

Based on the performance of the first unit over the past six months, two additional units are now on order. Phone or write your I-R man today requesting full particulars on the high tonnage performance of this and other Quarrymaster installations.

Ingersoll-Rand

5-747

11 Broadway, New York 4, N. Y.

DRIFTERS · JACKDRILLS · JACKHAMERS · CRAWL-IR DRILLS · CARSET BITS · AIR TOOLS · COMPRESSORS

MAXIMIX RUBBER PROTECTED

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

FEBRUARY 1959

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B.F.Goodrich

Photo by U.S. Bureau of Reclamation

Rubber builds a rock pile to hold back a river

B.F.Goodrich improvements in rubber brought extra savings

Problem: Millions of tons of gravel and clay will be carried two miles down that mountainside to build one of the world's largest earth-fill dams. Because of the heavy loads, only short lengths of ordinary conveyor belts could be used. But every extra transfer point where one belt dumps onto another adds to costs. They needed a belt strong enough to carry this "fill" from mountain top to the dam in just a few long hops.

What was done: Engineers recommended that the gravel and clay be carried by a series of only nine B.F. Goodrich Nyfil conveyor belts—one of them nearly a mile long. In this belt, nylon is used as cross threads in the fabric to give extra flexibility and decrease weight. Belts made with Nyfil fabrics have greater impact resistance, can carry heavier loads farther than belts made with ordinary fabrics. Yet these stronger, longer-lasting belts cost no more.

Savings: On this construction job, the number of transfer points was reduced almost to half by using B.F.Goodrich Nyfil belts. This means big cuts in construction, operation and maintenance costs. Almost 3000 tons per hour are carried by the nine B.F.Goodrich belts.

Where to buy: Your B.F.Goodrich distributor has full information on the conveyor belts described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Department M-526, Akron 18, Ohio.*

B.F.Goodrich *industrial rubber products*

Behind the By-Lines . . .

"I tell you, Doc, I feel fine. It's just that I've got this feeling that people are talking to me." Spencer L. Fencer was sitting in the psychiatrist's office. He was neatly dressed and outwardly calm, but his face showed the effect of some inner scar, perhaps the unexpected curtailment of a stockpile purchase program.

"Take it easy, Mr. Fencer." Dr. Maxwell Poltergeist tilted back his chair and placed his fingertips to his lips. Suddenly he leaned forward.

"Read *E&MJ*, Mr. Fencer?"

Fencer glanced from side to side. "Have for years, Doc. It's all right, isn't it?"

"Read the 90th Annual Survey & Outlook Issue?"

"Sure, never miss it. I mean it's all right, isn't it, Doc? I mean, that isn't what's causing my trouble, is it?" Fencer shakily lit a cigarette.

"You're the fifth patient I've had this week with the same problem, Fencer. Don't worry a bit. Here, I'll ask you a few questions:

"What's with vermiculite?"

"Funny you should ask that, Doc. Did you know they're going to use it as a fireproof bedding in horse's stalls at racetracks? Pretty interesting, huh?"

"Excellent, Fencer. You're doing beautifully. Now, what's the supply position in rare earths?"

"Not bad, Doc. You see, there was a lot of talk about scarcity, but that's clearing up now."

"Great, Fencer. Now, answer this. Do you have the feeling that while you're reading about gold, someone is talking to you about silver?"

"That's it, Doc! You're amazing. The little woman was right, I should have come to you days ago."

"Elementary, Mr. Fencer. You see, these people **are** trying to tell you something. After my fourth patient came in with the same trouble, I consulted with that crowd over at *E&MJ*. They're doing it deliberately.

"Seems they want to tell you how much is in their Survey and Outlook issue, and they figure the best way is to put quotes from the various reviews on pages scattered through the book. That way, you're bound to browse through it, constantly meeting quotes from other reviews, which will guide you to other quotes, and so on. Fiendish, isn't it?"

"Diabolical, I'd say. But Doc, won't this mean total abstention from television for at least four nights?"

"I know, isn't it grand?" The doctor rose. "Go home, Fencer, you're cured."

"Thanks, Doc. Say, before I go, did you notice that magnesium. . . . "

"Stop, Fencer. Not another word. I'm only half-way through Minor Metals."

If the above sounds a little like we've been whiling away the hours at the shoe-shine parlor with the works of S. J. Perelman, we can but plead guilty.

But we did want to tell you about the innovations in this, the ninetieth of our annual reviews, and after reading all these pages, darned if we don't have the feeling that people are talking to us, too.

Most of the people are old friends; some of them veterans of more than 15 years of surveying and outlooking.—And there are many new entries.

Last year, for instance, we ran one article under the heading of "Semi-Conductors." This year we don't have a semi-conductor heading—but we have three new commodity reviews: germanium, selenium and silicon. All in all, we're feeling pretty spry for age 90.

Before you push off into the world of major, minor and other metals and non-metallics, stop by the section which introduces the review and outlook articles.

While many of the surveys refer to the recent recession and its effect on individual commodities, there's evidence aplenty that mining is still vigorous.

Capital spending for the mining industry is one of the favorite indicators used by economists, and, with the cooperation of a number of *E&MJ* correspondents and the mining companies themselves, we've gathered an impressive picture of growth and continued expansion. True, it's not as impressive as in pre-recession days, but we're a long way from being counted out. See p 89.

Our Utah correspondent has forwarded a note which refers to the Shattuck Denn shaft sinking story (December 1958, p 96). He reports that Steele McIntyre, manager of the Mammoth Mining Co., Utah, maintains that the oldtimers were still the fastest and best shaft-sinkers in the mining business.

Mr. McIntyre refers to a column written for the *Salt Lake Tribune* by the late Burt B. Brewster, then its mining editor.

Mr. Brewster reported that a crew working only with hand-held sinking drills, etc., sank the old Water Lily shaft in Utah's Tintic District to a depth of 427½ ft in just 31 days. Sinking began July 15, 1921.

There's a trend under way, and we feel it's our duty to point it out. Once pointed out, we're not sure what else we can do about it, but here goes.

The following are headlines from ads in our own and one or two other business magazines. Like we say, we're just pointing out.

"Something New Under the Ground," "At home on the 'Range'." (They meant the Mesabi.) "The Splice of Life," "XYZ Mill Best by a Dam Site," and "Cables on the Rocks."

Maybe we ought to start a contest. " . . . And it's so easy! Just write your favorite slogan on the head of a pin, tear off the top of your neighborhood druggist and mail it in with twenty-five cents to this station . . . "

Our bulging file of Handy Signs for Plant and Office recently gave way. The one which flew the farthest was forwarded by a 12-year-old California-type niece of ours.

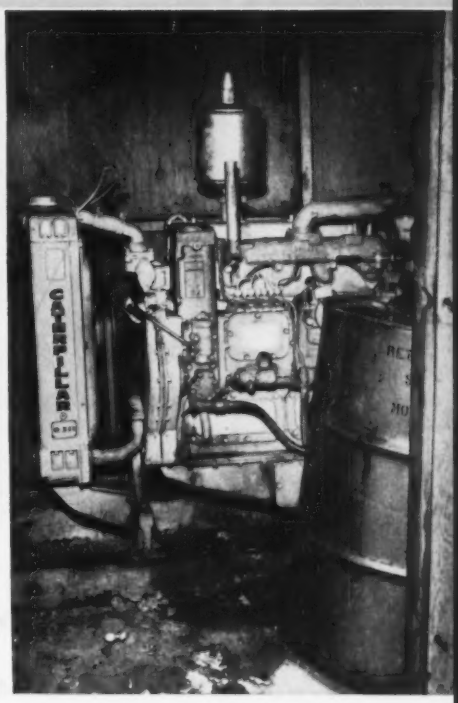
Your Criticism of This Product . . .

reveals an unsound technical background

engine power
BY CATERPILLAR

Cat Diesel Electric Sets . . . preferred where power is vital

Gas Hills location of Rissler and McMurry Company uranium mine . . . no place for power failure.



Cat D311 Diesel Electric Set provides dependable power 24 hours per day, 7 days a week, 12 months a year.

The Rissler and McMurry Company operates a uranium mine at Gas Hills, 50 miles east of Riverton, Wyoming. A Caterpillar D311 (Series H) Electric Set provides power for the camp. This includes all electricity for trailers and workshops.

Far from utility lines, the camp is never isolated from reliable power. The Cat D311 has run continuously since it was installed in October, 1957. THAT'S DEPENDABILITY.

"We have used Caterpillar equipment before," says Neil McMurry. "We know that we are purchasing equipment that will do the job expected."

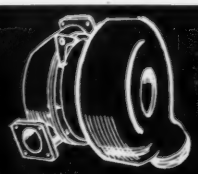
Caterpillar Diesel Engines are designed and built to last. The large, single orifice injector tip reduces chances of clogging and the entire injector system requires no adjustments. To maintain peak efficiency with minimum operating cost and minimum down time, specify Caterpillar.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

TURBOCHARGING: Turbocharging is standard on most Cat Engines. It gives more horsepower per pound of engine weight. Provides better performance at high altitudes.

CDES: Your Caterpillar Dealer Engine Specialist is the man to size up your job, recommend the right equipment, supervise installation. Your Caterpillar Engine will never be far from competent service and parts you can trust.

PORTABLE POWER: For exploration and development, van mounted Cat Engines are available. Caterpillar Electric Sets are made in a wide range of sizes for moving or permanent jobs.



CDES

To Increase Production and Lower Operating Costs...Specify

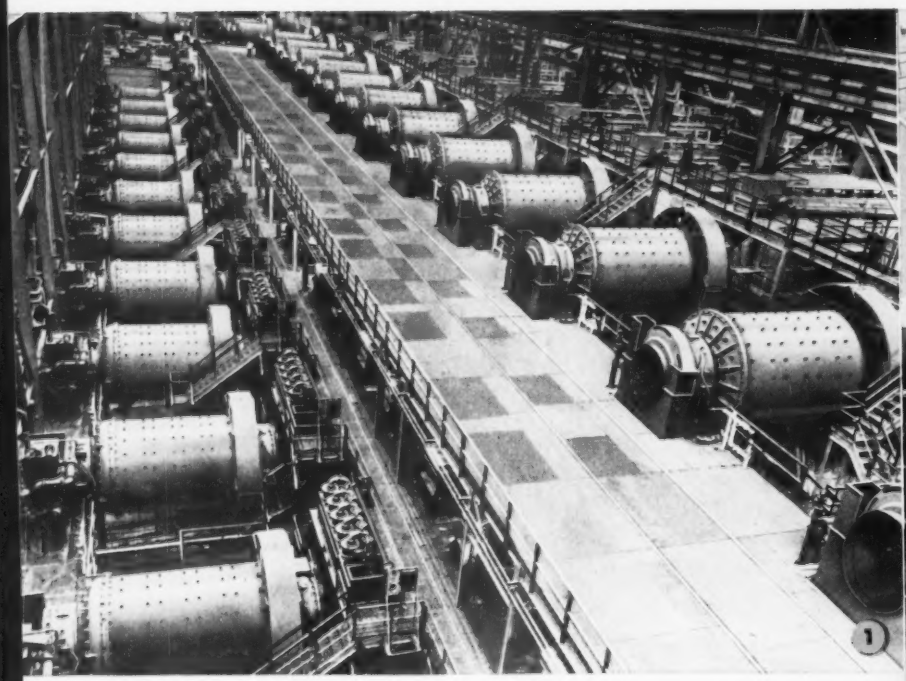
NORDBERG MINING MACHINERY

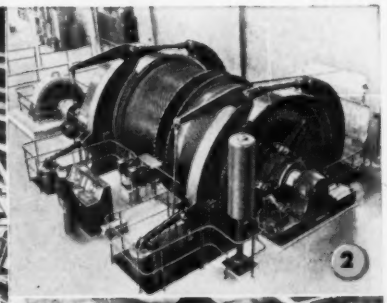
The complete line of heavy-duty Nordberg mining machinery includes Symons® Gyratory Crushers for primary breaking; Symons Cone Crushers for secondary and tertiary crushing; Grinding Mills; Symons Vibrating Grizzlies and Screens; Mine Hoists; and Nordberg Engines for mine and mill power.

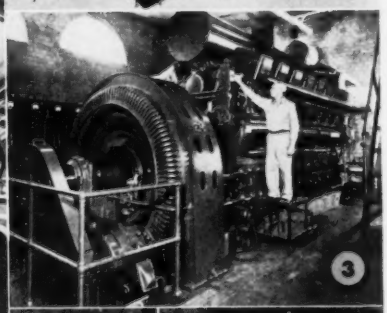
Rugged, heavy duty construction of Nordberg mining machinery assures continuous production at low operating and maintenance costs.

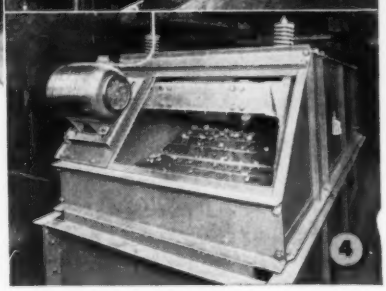
Here is mining machinery that is used by the world's leading producers of ores and industrial minerals.

Write for complete information.









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2 MINE HOISTS . . . Built in conventional drum types as well as in friction types, for hoisting both ore and men, in a wide range of sizes to meet large coal and metal mining operations.

3 NORDBERG ENGINES . . . From small power-units to large stationary plants, for Diesel, Duafuel®, and Spark-Ignition Gas operation, in sizes to over 11,000 horsepower.

4 VIBRATING SCREENS and GRIZZLIES . . . In types and sizes to meet practically all requirements from heavy scalping to fine screening applications.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

NORDBERG

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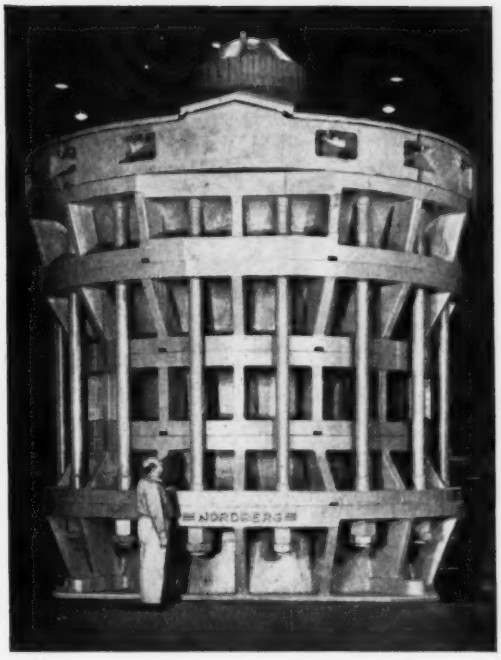
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

SYMONS CONE CRUSHERS

Built in 11 different sizes, ranging from 22″ to 7′ dia., for capacities from 6 to 900 or more tons per hour.

(Illustrated at the right is a typical installation of Symons Cone Crushers and Rod Deck Screens serving a large Taconite Iron Ore producer).



SYMONS GYRATORY CRUSHERS

For heavy-duty primary breaking, available with feed opening sizes of 30″, 42″, 48″, 54″, 60″ and 72″, for capacities to 3,500 and more tons per hour.

©1958, N. M. Co.

M158

New H-30 Merco Centrifuge, with increased speed and capacity, in operation at Argo, Ill. plant of Corn Products Refining Co.

NOW...

increased capacity in NEW MERCO CENTRIFUGE for nozzle bowl applications

Rotor speeds up to 3300 rpm and capacities up to 600 gpm are now possible with the new, improved H-30 Merco Centrifuge. At the same time, power requirements per gallon of feed have been substantially reduced.

In the first two installations, this new unit produced comparable removals at nearly double the capacity of previous models . . . and showed *no increases* in total power consumption.

This new operating efficiency is a result of improvements in rotor design, which provides greater disc area. Feed passages have been enlarged to accommodate increased flow.

The new Merco H-30 Centrifuge is particularly useful for clarification and thickening of slurries which contain fine solids (0.5 micron) over a wide range of feed solids concentrations (.02% and up). It is now available with a 30″ stainless steel rotor and bronze or stainless steel housing. In addition to its new large capacity and higher speeds, it contains these standard Merco benefits:

- The unique return flow principle that permits concentrating, washing, clarifying, classifying and recovery of soluble values at pressures up to 150 psi.
- No nozzle clogging or solids build-up in the unit.
- Overhead drive eliminates need for submerged bearing.
- Hydraulic hoist is built in to simplify inspection and maintenance.

If yours is a process that needs a large capacity centrifuge, there is a place for the Merco H-30 in your plant. For further information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

Merco—Reg. T.M. Pat. Off.

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CUSTOM ORE HANDLING EQUIPMENT

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YUBA has carried on major mining operations for half a century. So Yuba puts practical *working* knowledge into the *design and building* of mining *equipment.*

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Whether you're separating diamonds, iron or cassiterite – or moving millions of yards from deep river beds – *you'll find it profitable to phone, wire or write 675 East H Street, Benicia, California* –

Yuba Mining Division

YUBA CONSOLIDATED INDUSTRIES, INC.

YUBA

Where tires are put to the test

You can do more for less

on Tru-Seal Tubeless Rims

Wherever there's work to be done that's really tough on tires—you can be sure of this: You'll get more out of your tires – at lower cost – when they're mounted on Tru-Seal Tubeless Rims by Goodyear.

Tru-Seal is the only practical way to seal a multiple-piece rim. And, like all Goodyear rims, it provides other dollars-and-cents advantages:

Unusual Strength: An exclusive double-welding process and added support at points of greatest stress make present-day Goodyear Rims far stronger than previous rims.

Ease of Tire Mounting: No tube and flap troubles.

Special Tools: Goodyear provides both hydraulic and hand tools especially made for off-the-road equipment.

Bond-a-Coat Finish: This protective coating affords long-lasting resistance to rust and corrosion.

If you have a rim problem, talk it over with the G. R. E. (Goodyear Rim Engineer). He'll save you time and money by helping you select the type and size of rim best suited to your needs. Write him at Goodyear, Metal Products Division, Akron 16, Ohio, or contact your local Goodyear Rim Distributor.

New Tru-Seal Rims—available in sizes 12.00 and up, including all earth-mover and grader sizes. This rim is similar to multiple-piece rims now in use—PLUS air-tight Tru-Seal rubber ring which compresses into sealing groove when tire is mounted.

Buy and Specify **GOODYEAR**

More tons are carried on Goodyear Rims than on any other kind

METAL PRODUCTS DIVISION

Tru-Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Watch "Goodyear Theater" on TV—every other Monday, 9:30 P.M.,

Questions

We've been asked about the Yieldable Arch

"What kinds of mine can use the Yieldable Arch?"

The Yieldable Arch can be used in practically any type of mine where soft or heavy ground causes spalling or squeezing conditions. Yieldable Arch installations are being used in almost every type of mine you can think of—anthracite and bituminous coal, iron, copper, lead, zinc, nickel, bauxite, limestone, and asbestos.

"In our bituminous coal mine we have no problem with heavy ground or subsidence. What would we have to gain by putting in Yieldable Arches?"

It's true, of course, that roof control is the primary function of the Yieldable Arch. But it is only one of the benefits to be derived from a sound Yieldable Arch installation. We could cite a number of instances similar to yours, where Yieldable Arches have already paid for themselves through sharp reduction in maintenance expenses.

Send Us Your Questions: You probably have other questions of a specific nature concerning the application of the Yieldable Arch to your mine. If so, by all means send them in; we will study your questions and reply as promptly as possible. Write: Room 1041, Bethlehem Steel Company, Bethlehem, Pa.

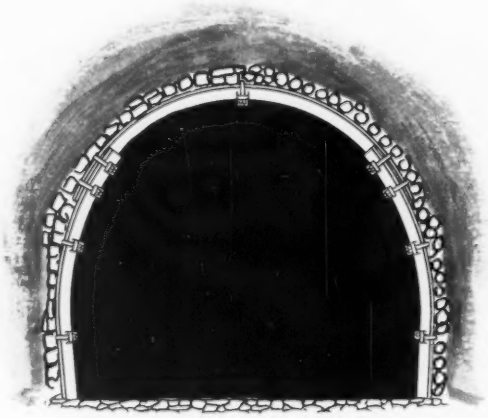
For example, even though you may have no subsidence problem, it's quite likely that spalling occurs or the entry may be subject to heavy roof falls, endangering personnel and requiring substantial clean-up time. Then, too, the Yieldable Arch is a long-service mechanism which will keep haulways and drifts open and clear almost indefinitely. Thus it is ideal for coping with such conditions, eliminating the time and money ordinarily spent in support-renewals and clean-up of falls.

A good job of lagging goes hand-in-hand with a good Arch installation. Lagging and packing act as a cushion; they fill in the voids between mine roof and Arches, keep the load on the Arches relatively uniform. Lagging may be either poles, planks, or timbers, or even old steel ties (see sketch below).

If you should consider the reopening of caved areas of old workings, Yieldable Arches will prove ideal in making and keeping the entries workable.

. . . . . .

Bethlehem's Yieldable Arch is made of U-shaped rolled steel sections. An Arch set is built up of three or more segmental lengths nested at the overlapped ends, and clamped together with U-bolt clamps to form a friction joint. This joint is designed to yield under excessive pressures, before deformation occurs in the steel, thus maintaining structural integrity in the arch while permitting the ground to relax gradually. Its success in mines all over the country can be described as little short of phenomenal.



Poles, planks, steel ties make good lagging.

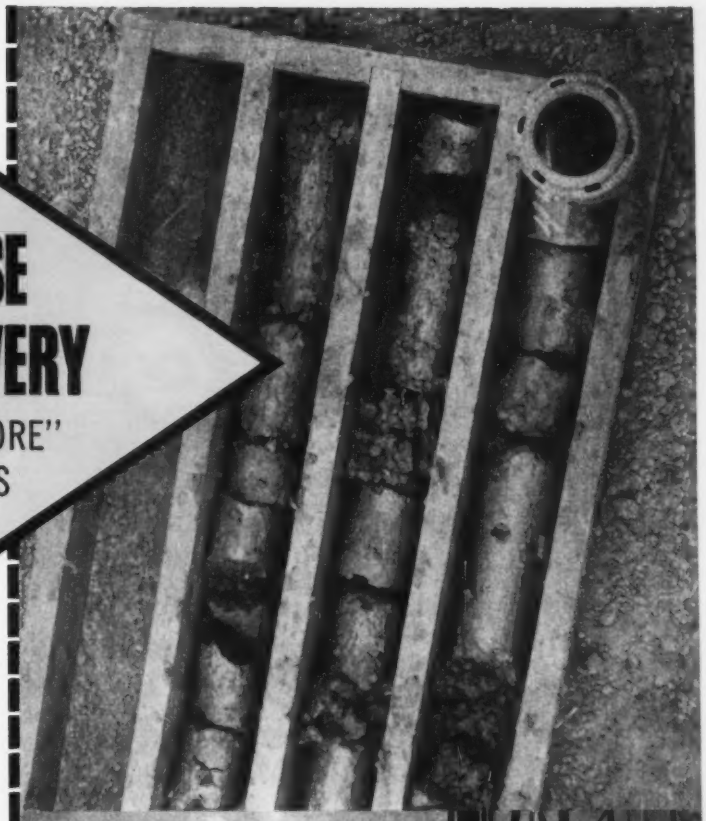
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

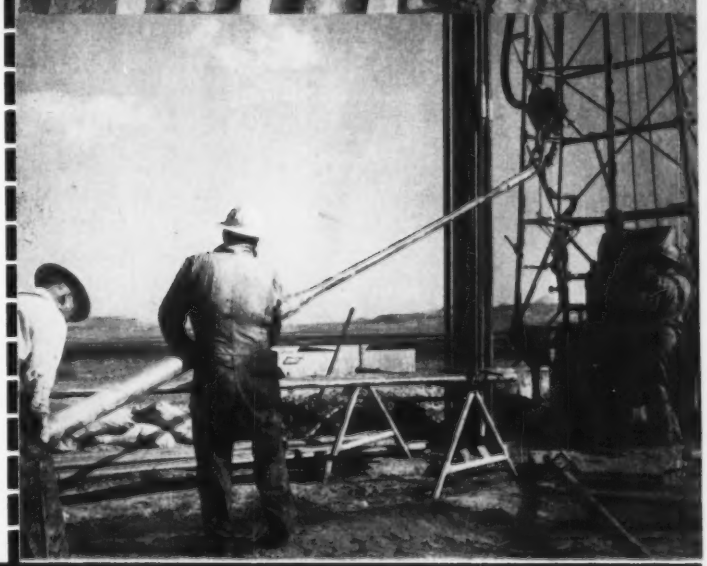
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corp. *Export Distributor:* Bethlehem Steel Export Corp.

BETHLEHEM STEEL

INCREASE CORE RECOVERY

IN "HARD TO CORE" FORMATIONS





Christensen adapts equipment to deliver highest percentage core recovery

Until recently the mining industry has had to put up with very poor core recovery in soft, sticky or unconsolidated formations, making accurate analysis of ore reserves extremely difficult. To increase core recovery Christensen, working closely with the operator, adapted equipment to the job. This newly adapted soft formation equipment cores ahead of the circulating fluid, protecting the core from fluid erosion. Today the geologist is receiving complete soft formation cores which enable him to fully analyze the ground below the rig for productive ore bodies. This is the result of a Christensen field consultant working in the field with the operator to adapt equipment to the job. **Whether it is soft formation or hard abrasive fractured rock, Christensen know-how is always available to help you increase core recovery and operate at "less cost per foot," regardless of operating conditions.** Call or write the Christensen field consultant nearest you today.

Every dollar invested in exploration is spent for the sole purpose of evaluating ore reserves. To properly analyze the ground below the rig, the geologist must have "good" cores. Christensen's 4½" x 3", B-3018 barrel delivers best possible cores in soft formations. For more detailed information write Christensen Diamond Products. Specify No. SF-967.

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

THE ALLIS-CHALMERS TR-260 ROCK WAGON

Extra power and capacity for bigger hauling output

230 HORSEPOWER • 20-TON PAYLOAD

Here's news worth swinging around to see...

The new TR-260 delivers up to 15 percent more horsepower than other hauling units in its size range . . . extra power for better acceleration . . . faster hauling cycles. The TR-260 also gives you more load-carrying capacity than ever before . . . two extra tons. You'll like the new TR-260 design . . . and the low TR-260 price. Get facts and figures . . . and a hauling demonstration at your mine. You'll be convinced—and dollars ahead if you buy.

230 horsepower—more than 11.5 available horsepower for every payload ton.

90-degree turns—you save an average of 15 seconds per cycle when spotting under shovels or backing up to hoppers.

U turns in only 24 ft, 4 in.—you require 20 to 50 percent less turning space than wagons of comparable size.

High ground clearance—with 25¾-in. wagon clearance, the R-260 rolls over high spots. No hang-up problems.

Five speeds to 28 mph—you shift quicker, easier with constant mesh transmission and new actuated transmission brake . . . no double clutching.

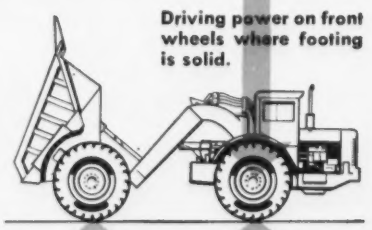
Bigger tires—26.5 x 25 low-pressure tires swallow humps and holes with less chance of damage to themselves . . . far less shock to the entire unit. Better traction and flotation, too.

68-degree dumping angle—material rolls out of the clean, unobstructed bowl in a hurry.

TS-260
MOTOR SCRAPER
17 cu yd heaped
230 horsepower

TR-260
ROCK WAGON
20 tons
230 horsepower

Fixed wheel base—solid as a rock . . . and safe . . . The TR-260 dumps with all four wheels braked . . . no need to back up tractor to get loads out. And on the getaway, power is on the forward wheels where footing is solid. No bog-down on embankment lip.



Interchangeability for added earnings . . . The T-260 tractor hauls either the R-260 wagon or S-260 scraper interchangeably. Use the TR-260 for off-the-road hauling—then switch to the TS-260 for stripping or contract earth moving. Earnings are increased . . . you get 100 percent tractor efficiency and reduce equipment investment at the same time. *Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.*

move ahead with **ALLIS-CHALMERS**...power for a growing world

Best For Main or Auxiliary Air Supply!

Above: 9′ Joy Axivane Mine Fan teams with an 8′ Joy Fan to provide main ventilation system for Climax Molybdenum Company mine.

Left: 10 H.P. V-belt drive Joy Axivane Fan moves 50,000 feet of air each minute. Ideal for auxiliary or small-mine ventilating duty. Photograph courtesy U.S. Bureau of Mines.

JOY AXIVANE MINE FANS

MAIN AIR SUPPLY Low operating speed, wide operating range, simultaneous . . . and easy . . . blade adjustment, and ready bearing accessibility assure you efficient, dependable ventilation for your mine. The big 9′ Joy Axivane Fan illustrated at top right is in operation at Climax Molybdenum Company's mine in Climax, Colorado. This V-belt driven fan produces air volumes from 81,000 CFM to 770,000 CFM, and above, with pressures up to 15″ w.g. It teams with an 8′ Joy Fan to furnish the main air supply for the Climax mine.

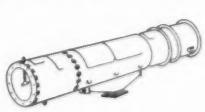
AUXILIARY AIR SUPPLY The 10 H.P. V-belt drive Joy Axivane Fan, illustrated at top left, moves 50,000 feet of air each minute with total pressure of .75 inches. Fitted with reversible motor, this efficient air-moving machine is ready to exhaust stale air or draw in fresh air for the working crews. Remote-controlled adjustable blades allow you precise control of air volume and pressure. It is designed for auxiliary ventilation service in a large mine or for primary ventilation in a small mine.

The vaneaxial design of Joy Mine Fans conforms to the latest formulae of aerodynamics . . . to give you increased efficiency and greater power savings. Joy Axivane Mine Fans are available in sizes up to 12′ in diameter, with air volumes up to 1,120,000 CFM. For full details write to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 56-4

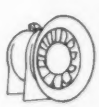
JOY . . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

STATIONARY COMPRESSORS



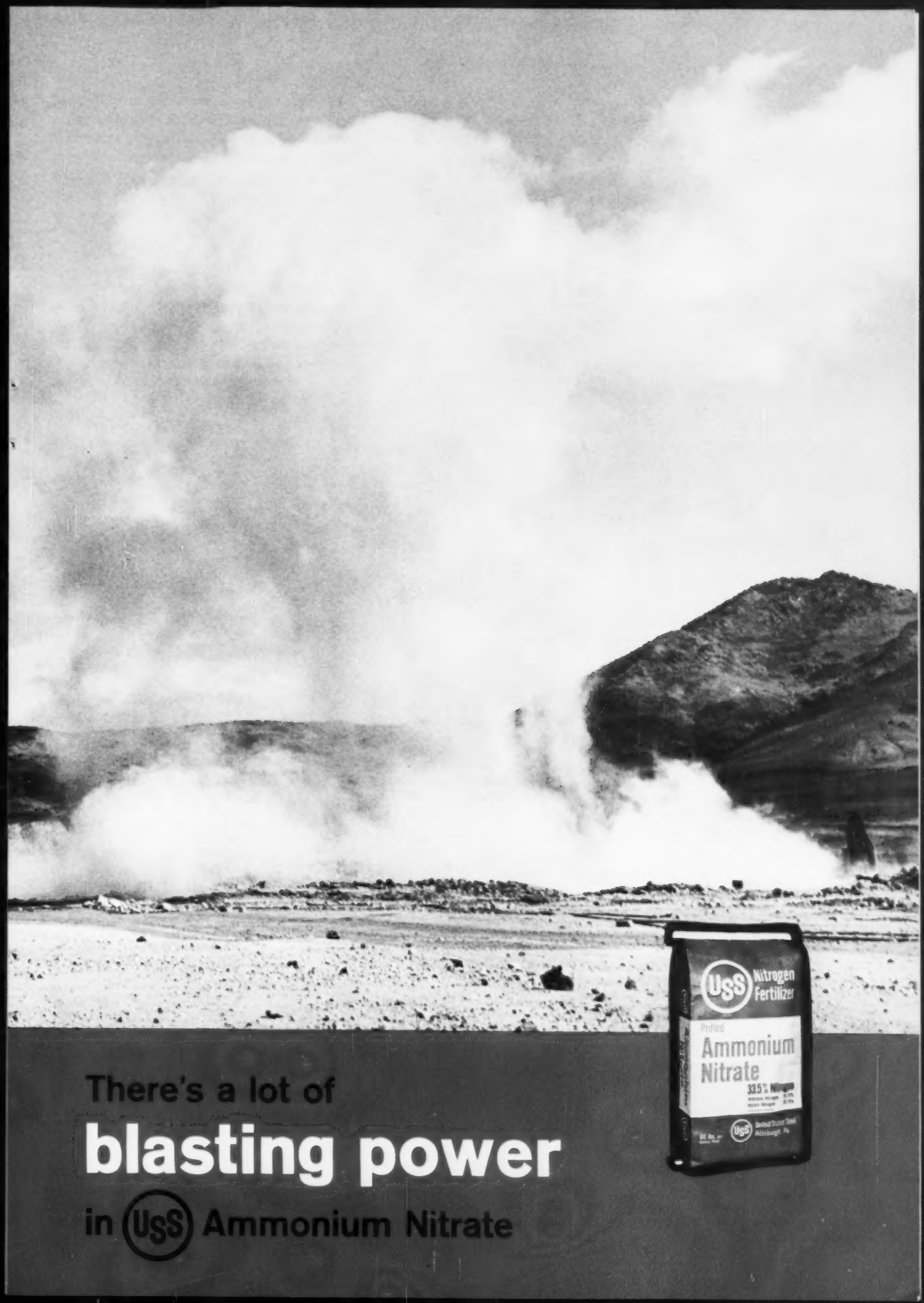
DUST COLLECTORS

ELECTRICAL CONNECTORS



FANS AND BLOWERS

WSW CL5967-56


There's a lot of
blasting power
in USS Ammonium Nitrate
USS Nitrogen Fertilizer
Prilled
Ammonium
Nitrate
33.5% Nitrogen

Safe, low-cost blasting with USS Ammonium Nitrate

USS Ammonium Nitrate, mixed with fuel oil, is bringing substantial savings in the blasting operations of mining and construction companies.

USS Ammonium Nitrate has these principal advantages:

Low cost: Prilled ammonium nitrate is used in the same ratio as other blasting agents—yet it costs far less.

Excellent fragmentation: Many firms report fragmentation of material is better with ammonium nitrate-and-fuel mixture than with any other blasting agent. Ammonium nitrate has eliminated much costly secondary blasting at many operations.

1 Electric-driven rotary drilling 40-ft. blastholes 9 inches in diameter along 33-ft. benches.

2 Powder crew places required number of bags around hole and one man slashes top of each bag.

3 Second man pours diesel oil into USS Ammonium Nitrate bag. For best performance, prills should be uniformly oil-coated.

7 Remaining bags of USS Ammonium Nitrate are poured on top of primer. Hole is stemmed with drill cuttings and tamped.

8 Trunk line of primer cord is strung along loaded row. Loose ends from primers set in holes are attached.

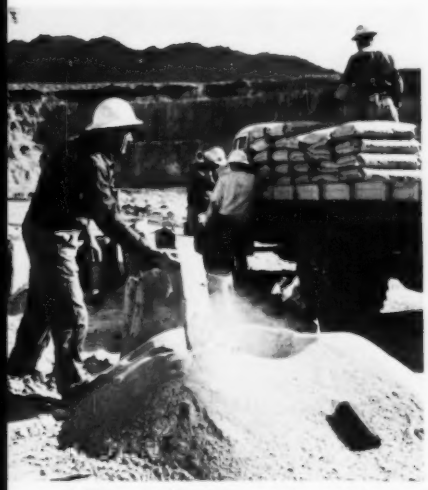
9 Charge is detonated in record time, with increased safety of operation and full consumption of explosive.

Ease and safety in handling: Prilled ammonium nitrate is not cap-sensitive. This means it is safer to handle, store and transport than conventional explosives. Diesel oil can be poured directly into an opened bag of ammonium nitrate, or mixed automatically by equipment at the time of loading of holes. When oil is poured into the bag, many companies use about ½ gallon of oil to a 50-pound bag. Several companies report increased efficiency if the bag is allowed to stand for several days to allow oil to saturate the prills.

Versatility: USS Ammonium Nitrate is being used effectively in large and small holes and in both horizontal and vertical holes. It has brought substantial and increased efficiency in blasting operations, in open pit mining, earth moving, road construction and in quarry operations of all types.

Results: USS Ammonium Nitrate, mixed with oil, is lowering blasting costs, achieving better breakage and proving to be a safe and easy-to-handle blasting agent.

A successful operation. The photographs on these pages show how one western firm is using USS Ammonium Nitrate mixed with oil in its blasting operations, with a substantial savings in costs.

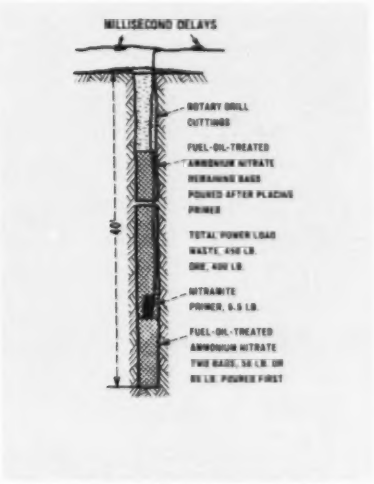


4 Two 50-lb. bags, each containing about ½ gallon of oil, are dumped into bottom of hole.

5 Primer, 5½-lb. Nitramite, is tied with Primacord in next step.

6 Careful placing of primer follows. All safety rules are followed.

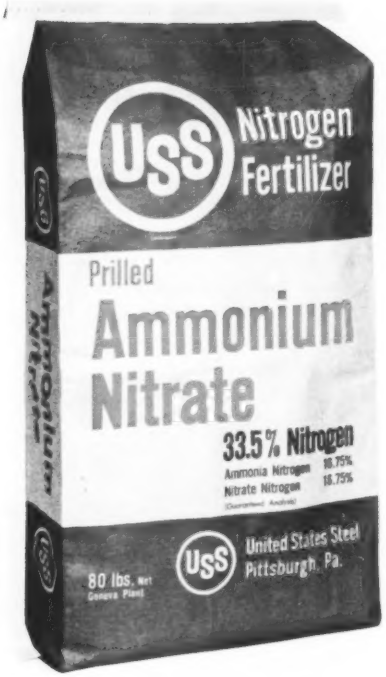
10 Superior fragmentation has eliminated secondary blasting costs. Total blasting costs are greatly reduced.



11 New low-cost blasting method showing the ammonium nitrate system.

USS

Ammonium Nitrate



You will like
USS Ammonium Nitrate because—
It flows freely.
Does not lump in the bag.

There is a
reliable source of supply
It's packed in plastic-lined bags.
You have it when you need it.
It is low in cost.

USS is a registered trademark

You can order USS Ammonium Nitrate in bulk or in 50- or 80-pound bags.

United States Steel, Chemical Sales Division
Room 919, Kearns Building
Salt Lake City, Utah

I am interested in knowing more about USS Ammonium Nitrate as a blasting agent.
Please send me more information.

Name .....

Title .....

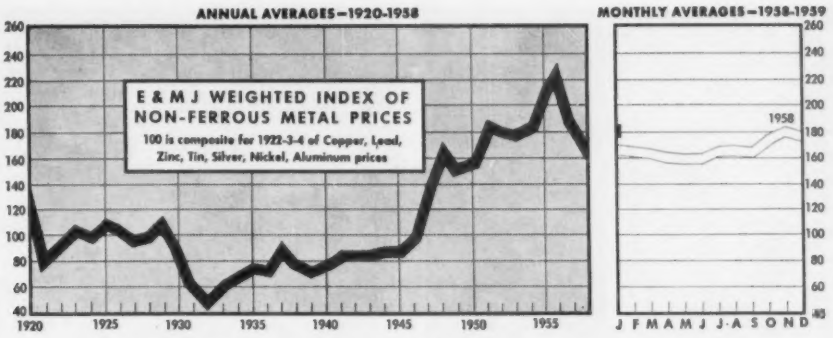
Company .....

Address .....

USS **Ammonium Nitrate**

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1938
E & M J WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES—1938-1939
1958
J F M A M J J A S O N D

MARKETS

A mid-month drop of one cent in the lead price shaved *E&MJ*'s metal price index from 183.95 for December to 183.41 for January. Copper, silver and tin moved up slightly; nickel and aluminum were unchanged.

●

AT HOME

The $739,600,000 budget for procurement of domestic, Canadian and foreign uranium for fiscal year 1960 is the largest request ever made for uranium. Uranium Institute estimates that the budget for procurement of domestic uranium will be about $320-million.

After having test-drilled 57,000 ft of hole in various types of rock formations with the new powerful down-the-hole "Turbodrill," Dresser Industries, Inc. is undertaking an evaluation program to adapt the drill to American drilling conditions.

Commercial-grade titanium tetrachloride has been produced from ilmenite in the U. S. Bureau of Mines laboratory at Albany, Oregon. The program was undertaken to reduce dependence of the U. S. on rutile imports.

The Anaconda Co. has acquired a 90% interest in an iron ore deposit situated about 100 miles north of Lake Superior. The large reserves of low-grade magnetite can be mined by open-pit methods and concentrated by magnetic methods to produce a 65% product. John B. Knaebel has been appointed president and managing director of Anaconda Iron Ore (Ontario) Ltd., a subsidiary of the Anaconda Co. (Canada), Ltd. In making the announcement, Clyde Weed, Anaconda chairman, said that the company had not materially reduced its expenditures for exploration, and did not plan to do so unless economic conditions made it necessary.

●

LABOR

Three-year labor contracts with major nonferrous metal producers will end on June 30. International Union of Mine Mill and Smelter Workers will direct much of its attention to demands for new contracts beyond June 30 at its San Francisco convention in mid-March. IUMMSW is also probing the cause of diminishing payrolls in the face of increasing production.

●

ABROAD

First shipment of Dominican Republic bauxite ore arrived at Alcoa's new alumina refining plant at Point Comfort, Texas in January. The shipment culminates a $14-million development and exploration program in Dominican Republic. The Point Comfort plant, now undergoing shakedown operation, will have an estimated capacity of 750,000 tons of alumina annually.

Export-Import Bank has issued a $12.5-million credit to Companhia Vale do Rio Doce to purchase railroad, port and mining equipment in the U. S. The Brazilian company plans to raise its high-grade iron ore production to 6-million tons a year.

Export-Import Bank increased its former $100-million loan to Southern Peru Copper Corp. by $15-million to help meet added costs caused by inflation and added construction costs.

THIS MONTH IN MINING

A RARE USE of monitors underground is being carried out near Phillipsburg, Mont. by Silver Butte Mine. Above 450 tpd of zinc, lead and silver are being removed, piped to ponds and settled. Trucks haul the settled material to the mill.

Montana Firm Uses Hydraulic Method on Lead-Zinc

UNDERGROUND hydraulicking is being worked at the Silver Butte Mine, 15 miles northeast of Phillipsburg, near Maxville, Granite County, Mont. It is believed that this is the only type of underground metal mining of its kind operating in the U.S. Principal ore deposits are zinc, lead and silver with combined production of about 450 tpd.

Water under high pressure is introduced into the 40-ft vein on the lowest level causing an automatic caving system to wash the ore from the decomposed porphyry dike. By suction and gravity and through two 14-in. pipe lines which discharge by gravity the ore is washed down by a 70 psi hydraulic giant and flumed and piped out from the face of the 1300-ft drift. It is piped 4300 ft to Smelting Refining Smelter in East tpd capacity. The ore from the settling ponds is loaded into trucks and discharged to the mill chute and into the flotation plant. A branch of the Northern Pacific Railroad carries the silver and lead ore from Maxville to the American Smelting & Refining Smelter in East Helena while the zinc goes to the Anaconda Co. smelter in Anaconda.

The vein is almost vertical, and the walls are of good solid limestone. Boulder Creek, flowing within 50 ft of the tunnel portal, provides the water under pressure which is ideal for mining the deposit and for effectively dissolving mud and clay from the ores. Power is provided by the Montana Power Co. for the compressors, mill operations.

Because of the amounts of mud and slime in the ore deposits which cause swelling and excessive weight, a new method of mining had to be employed. Under standard mining method the cost of timbering would be prohibitive. The present method with the upgrading makes this operation very low in cost—since the limestone provides much of the necessary support.

The mine, formerly the Treasure State Uranium Co., was bought out by Silver Butte Mines, a Canadian firm, in December 1957. Earl Ellis, hydraulic mining engineer of Butte, is mine superintendent. He and Edward C. Hughes, Butte, are directors of the company. H. M. S. Tremaine, Canadian mining engineer, is general manager.

Early in December Mr. Hughes indicated that a number of changes were being made at the property this winter. Because of the freezing of the settling ponds during the severe winter weather, mechanical upgrading using jigs and cones is being installed. A 12-in. heavy duty pipe-line one mile long which will drive six additional hydraulic headings to stopes is being added. Two 75-hp Ingersoll-Rand pumps are being installed for additional water pressure. The pressure of the hydraulic giant is being increased to 125 psi. A new three wheel Denver Equipment Co. filter is being added.

Twelve men are presently employed in putting in the new equipment and making the changes in the upgrading operation.

The mine has been operating only with power provided by the system of gravity and suction already described.

The whole operation is at an elevation of 7,000 ft.

Illinois Fluorspar Mines Near "Standstill"

THE END of Federal stockpiling of acid grade fluorspar on Dec. 31, 1958 brought production in the Illinois mining district to a virtual standstill.

Some major operations have been shut down completely while others will continue, for the time being, on a drastically reduced schedule.

Operators take the position of "we'll just hang on and wait to see what will happen."

Southern Illinois Mining Co. has closed down its Hardin County mine and mill properties permanently, according to announcement by H. C. Morrison, company manager.

All contractors holding leases on mining properties of Rosiclare Lead and Fluorspar Mining Co. have suspended operation.

Ozark-Mahoning Mining Co., according to A. G. Johnson, vice president and general manager, has closed down its western fluorspar properties, located at Jamestown and Northgate, Colo., for an indefinite period, but will continue operation of its Rosiclare, Ill., plant on a reduced basis of 50% capacity. Ozark's three plants produce approximately 98,000 tons of acid grade fluorspar annually, including 50,000 tons at Rosiclare; 12,000 tons at Jamestown; and 36,000 tons at Northgate, with ample supplies of crude ore available to keep the plants in operation for an indefinite period.

Minerva Oil Co., fluorspar division, which operates several mines and two mills in the Hardin County district, will curtail its production sharply, according to Gill Montgomery, general manager. It hoped however to hold its two plants, Minerva No. 1 and Crystal, in at least into February, working one plant for a week and the other, the following week, with a skeletal crew held together for repairs, Minerva's O. E. Anderson said.

Other properties which suspended operation as a result of the end of stockpiling include Hoeb Mining Co., Hawkins Mining Co., Tamora Fluorspar Mining Co., Omar Austin's mine and mill, Conn and Joiner; Goose Creek Mining Co., B. Burgess Mining Co.

The Colorado properties of Ozark-Mahoning will be kept on a standby basis for a limited time, pending possible imposition of a quota system on importation or additional stock-piling.

Southern Illinois Mining has shut down its barge loading facility on the Ohio River at Rosiclare. Foremen will be retained at the mine and mill for the present.

Seeing the domestic industry at its lowest ebb in history, fluorspar operators believe their only hope for survival lies in legislative relief from excessive foreign imports. For the last two years the industry has stayed alive largely through Government stockpile purchase. Application for quota limitation now is pending investigation by OCDM and an early report is anticipated.

Domestic operators, in the words of Ozark-Mahoning's A. G. Johnson, "favor a quota system which will enable the domestic fluorspar producers to stay alive and be able to serve the nation in time of national emergency."

Only Alcoa's Rosiclare fluorspar works, continues operation on a normal basis. There is no plan of curtailment, and operation of its Rosiclare mill is on a 5-day work schedule.

Alcoa, in fact, plans to resume a development program at its Shouse-Skelton fluorspar property in Livingston County, Ky., between Carrsville and Joy. Exploration and geological investigation will get under way within two months in preparation for active mining operation in about two years, according to Walter S. Skeels, works manager.

Mining Calendar

Symposium, "The Application of the FluoSolids Reactor to the Mineral Industry," Univ. of Ariz., Tuscon, Feb. 23 to Mar. 3.

Twenty-first American Power Conference, Illinois Institute of Technology, Hotel Sherman, Chicago, Ill., Mar. 31.

Canadian Institute of Mining and Metallurgy annual meeting. Queen Elizabeth Hotel, Montreal, Apr. 13 to 15.

Third Symposium on Rock Mechanics, Colorado School of Mines, Golden, Colo., April 20 to 22.

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, Pa., April 27, 1959.

American Society of Photogrammetry—American Congress on Surveying and Mapping, Washington, March 8-14.

12th Annual Midwestern Exploration Meeting, El Paso, Tex. April 28-29.

Uranium Section, AIME, Moab, Utah. May 8-10.

35th Annual Conference of Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn. May 21-22.

Open Pit Mining Association, annual meeting, Rolla, Mo. June 18.

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

(*Continued on p 176*)

As We Went to Press . . .

An extraordinary rich gold reef, averaging 9,772 in-dwt has been exposed at Free State Geduld Mine, one of the Anglo American Group in the Orange Free State. (In.-dwt are computed by South African miners as the product of the pennyweights of gold per ton times the length in inches across the sample. A pennyweight equals 1/20 oz troy. In estimating value of ore as mined, it is customary to assume at least 36- to 40-in. width, which means that the value of ore mined expressed in dwt per ton would be 1/36 to 1/40 of the in.-dwt assays quoted.)

The reef was intersected southwest of the No. 1 shaft. The marked improvement in development results represent an area only 110 ft on the dip and 50 ft on the strike, but the company estimates increased high values in the area.

Negotiations for a nuclear blast experiment to recover more petroleum from the Athabaska tar sands began Jan 26 between Richfield Oil and the Canadian government. Richfield leases about 2-million acres at the site in northeastern Alberta.

Stripping has begun at a major iron property near Coleraine in Minnesota, on the west end of the Mesabi, by Jones & Laughlin's Minnesota Ore Division.

The 700,000 tons per year property will be operated from two open pits on either side of the Prairie River. A wash ore plant, designed by Western-Knapp Engineering, will be constructed to take the high grade ore. Heavy media plants will be added "as leaner ores are encountered," says J&L, but not at the early stages.

The mine, called the Lind-Greenway, is expected to begin production in April 1960.

Proposed legislation to re-define "mining" is being drafted by the Treasury Department for use in the Internal Revenue Code's sections on percentage depletion for mineral products.

"Mining" is defined presently to include ordinary treatment processes normally applied to get the "commercially marketable finished product," which Anderson argues, could be an expensive finished product. He wants to strike the "commercially marketable" phrase and substitute a new definition of mining which would specify the allowable treatment processes. Treasury officials said mostly nonmetallics would be affected by the proposed amendment. The code is already sufficiently specific on most metals, they said.

Announcement was expected of the development of Wabush Iron Co.'s deposit in Quebec-Labrador very shortly. Wabush, owned by Pickands, Mather & Co., Interlake Iron Co., Youngstown Sheet & Tube, Steel Co. of Canada and Canadian Javelin, Ltd., is expected to exercise its option on the Wabush Lake deposit and begin development. Completion of a 42-mile railroad to the property was announced last month.

Toronto rumors held that the 10% of Wabush held by Canadian Javelin might be picked up by PM and the others before long.

A rise in the price of gold, according to the Treasury, is not to be expected merely because of the bills being introduced in Congress to that effect. The Administration went "out of its way" during the budget hearings to make the point.

WASHINGTON IMPACT

Highlights

THE GOLD BUG has bitten Washington. Reaction was fast and furious to the introduction of legislation in the opening days of the new Congress last month by Sen. James Murray (D.-Mont.) and other Congressmen to double the pegged price of gold from $35 per oz to $70 per oz. The implications of such a move (see page 22) are many and important —for domestic mining, the U.S. economy, and international finance. The trouble is, economists can't agree among themselves on all its effects.

Opposition is strong, both in the Administration and industry in this country and from overseas, on the grounds this would weaken the dollar in international finance. But there also is new interest and pressure for the move, which has often been proposed in the past without getting anywhere. In addition to its obvious benefits to gold producers, it is being backed as an indirect subsidy to copper, lead and zinc mines which produce gold as a by-product, and as a much-needed stimulus to a hungry Alaskan economy.

CONGRESSIONAL STRATEGY—This session of Congress will take up a number of issues with important bearing on the domestic mining industries, direct and indirect. But there won't be another concerted attempt at an over-all long-range minerals policy bill replete with stockpiling or subsidy incentives to a wide range of producers, like the one that failed in the House last year.

In fact, stung by the House defeat of the Murray-Seaton bill last year, mining state legislators have agreed that any important mining legislation this year will be taken up first in the House. Then if it wins approval there, the Senate will take over. But the powerful Senate Interior Committee headed by Murray won't risk a repeat of its resounding House defeat again this session.

Add to the surprising minerals committee changes on Capitol Hill (*E&MJ*, January 1959, p20) the appointment of Rep. Adam Clayton Powell (D-NY) as chairman of the House Interior Minerals Subcommittee. Powell, as a liberal New Yorker, has been viewed by some observers as an ironic choice to have an important say on the legislative proposals of conservative midwestern Republicans and southern Democrats represented in the mining industries. But House Interior Committee chairman Wayne Aspinall (D-Colo.)—himself regarded as friendly to mining interests—is reported to have Powell's unqualified backing.

. . . AND ISSUES—Congress this year will consider important legislation covering tax depletion, small business benefits, gold pricing policy, international finance, and many other areas touching domestic mining. The bills will be entirely apart from the specific consideration of particular metal-mineral problems. Some of the latter group will get further than others. For example, the outlook for lead-zinc legislation depends on how domestic import quotas stand up and what happens in international talks on voluntary controls, scheduled to start again in March. Stockpiling bills, per se, like the one introduced by Sen. Pat McNamara (D-Mich.) for iron ore and copper stockpiles won't get anywhere—they are put in the hopper for obvious political reasons.

Aside from over-all legislation affecting mining and specific minerals bills, Congress also will exercise its interest in Administration policies in this field, including trade law decisions and others.

Barter, for example, will probably get another Congressional review. Industry dissatisfaction with the newly expanded barter program is being felt on Capitol Hill. One instance is the apparent restrictions on including significant quantities of lead and zinc. Some observers see in the refusal to expand lead-zinc barter a Washington attempt to win Canadian backing for international lead zinc controls. An international agreement, however, is still a long-shot bet.

One plan getting aired in Congressional corridors is a proposal to turn foreign currencies paid to Agriculture Department's Commodity Credit Corp. for surplus crops over to Interior Secretary Seaton to be used for incentive purchases or other subsidies of domestic minerals, such as fluorspar. An extension of this idea is to actually turn over surplus crops to Seaton to sell overseas for foreign money to be used in the same fashion.

Eisenhower Budget Shows Decreased Stockpiling

EISENHOWER'S CONTROVERSIAL BUDGET for fiscal 1960 is not likely to raise any industry eyebrows over its stockpiling or metal-mineral development funds. As expected, it confirmed in so many words the well-known fact that stockpiling programs are running out.

In a 1960 entry of $265-million for stockpiling programs — compared to $378-million last year and $625-million the year before—only $125-million is earmarked for new expenditures, that is materials that are not already contracted for delivery to the stockpile.

However, Eisenhower did say in his budget message that an additional $325-million would need to be authorized this calendar year to meet contract obligations over the next two calendar years.

For mineral resources, the budget calls for another $186-million to be spent this fiscal year, plus an additional $192-million to be authorized for future expenditure. This category includes Bureau of Mines and Office of Minerals Exploration programs of finding new mineral resources, improving processes, and upgrading present stocks.

Tougher Depletion Rules Are Expected This Year

THE ADMINISTRATION wants to limit the tax break the courts gave mine operators who do some mineral processing. In his budget message to Congress, President Eisenhower said the Treasury Department will recommend legislation to specify the treatment processes which can be considered "mining" for purposes of computing percentage depletion.

The idea is to limit the scope of recent court decisions, in effect upheld in 1957 by the U. S. Supreme Court (*E&MJ*, p136, November 1957). The courts allowed application of percentage depletion to the full sales price of finished products—including some nonmining costs, such as processing or manufacturing steps, which the courts considered treatment processes necessary to produce a marketable product.

Alcoa Ups Small Users Share of Aluminum

AS A RESULT of Congressional pressure, Aluminum Co. of America and the General Services Administration have agreed to a new supply contract to assure small business users of the metal a bigger share of aluminum which the Government has first call on, but which it has been diverting to private industry.

Under Korean War supply contracts, GSA got a 5-year lease on the new Alcoa production stimulated by Government demand, and Alcoa also agreed to supply 25% of the new output to non-integrated

users for a 15-year period at the end of the 5-year term. In 1957 Alcoa agreed to up that percentage figure 10% to 35% of the output of its new facilities.

The new contract change specifically reserves that 10% increase for non-integrated users who qualify as small businesses.

Administration Widens "Essentiality" Limits

ONE OF THE MOST significant new avenues to Administrative trade protection under the new trade laws is the so-called section 8 or "defense essentiality" clause under which petitions may be filed with the Office of Civil and Defense Mobilization. Investigations under this section are currently underway on cobalt, fluorspar and tungsten.

Last month the OCDM put out new regulations for filing under section 8. They point up the new criteria which the agency will now consider in ruling on national security matters.

For example, "upon application of any interested party," including OCDM itself, an investigation of imports may now be initiated. Criteria now include defense requirements for "restoration and rehabilitation" after attack as well as requirements before. One of the effects of competing imports now to be taken into account is "the economic welfare of the nation," including "any substantial unemployment, decrease in revenues of Government, loss of skills or investment, or other serious effects.

Commerce Defines Trade Position Versus USSR

EAST-WEST TRADE TALKS between visiting Soviet Deputy Premier Anastas Mikoyan and top trade policy makers in State and Commerce Departments in Washington last month cleared a lot of fog away from the issue, at least. Main points that were underlined by Commerce Secretary Lewis Strauss and State Economic Undersecretary Douglas Dillon:

- The U. S. Government isn't going to make any significant change in its East-West trade controls. In fact, said Strauss the day after he talked to Mikoyan, they might have to be tightened rather than loosened further.
- Washington officials told Russia's trade expert that the USSR can expand normal trade through existing commercial channels if it really wants to. Privately, officials think trade means more to the Kremlin as a propaganda weapon than as a real economic basis for expanding commercial relations.
- Dillon frankly told Mikoyan to offer the U. S. market something other than nonferrous metal-mineral products which are in ample domestic supply from domestic producers, or friendly importers in this hemisphere, or both.

Labor This Month

LABOR WAR FLARES UP: This month, leaders of AFL-CIO unions must face-up to an old labor rivalry that is threatening to explode. The rival craft and industrial unions that make up the AFL-CIO are again on the outs—but this time they may not be able to smooth over the trouble. The basic dispute is this: There are not enough jobs to go around in the wake of the 1958 recession, and the industrial giants such as the Steelworkers and United Auto Workers are battling the plumbers, carpenters and other craft unions for what is available. They're living under the same union banner within the AFL-CIO, but soon they may blow the roof off the house of labor.

HIGH-LEVEL LABOR PEACE HUDDLES: Led by George Meany, top union chiefs took their problems to a mid-winter conference in Puerto Rico. With Walter Reuther making the case for the industrial unions, and plumbers' president Peter Schoemann holding forth for the construction unions, the hope was to find a peace formula that has eluded the labor movement for 20 years. It caused the original split of the AFL and CIO unions; it was partly checked when the unions merged three years ago—and now it has reached a critical level. The dispute, says plumber Schoemann, can "divide and destroy the house of labor and repudiate unity and set aside the merger agreement." If this happens, it would collapse the combined union operations, such as political lobbying and organizing and the other services provided by the single labor federation. The split would come not only at national headquarters, but at the state and city AFL-CIO groups which combined in a follow up of the alliance at the top.

AUTOMATION AND UNEMPLOYMENT WOES: When last year's recession receded it left a lot of unemployed, particularly in the giant steel, auto and related industries. The new assembly line automation needed fewer workers when full production resumed, many thousands lost out completely to the machine. This meant pressure for available jobs—and such plant jobs include construction work which, traditionally has gone to the craft unions. But with available manpower, the industrial unions haven't wanted to give up work to outside unions. Conversely, building tradesmen are battling to hold on to the skilled posts, and keep jurisdiction over the new skills that are being demanded by automation. This pits union against union, member against member. This is not only an early 1959 problem. It is one that will advance with the calendar.

ORGANIZING—THE FUSE: The AFL-CIO feud now centers between the industrial unions and the AFL-CIO metal trades department representing metal working unions. Frequently, this department has organized for its member craft unions—going on a National Labor Relations Board representation ballot as a single union. Then, where it wins the election, the department has divided up the union members among its metal union affiliates. This practice has Reuther's auto workers and David J. McDonald's United Steelworkers up in arms. They demand it be stopped; argue that the department as a service arm of the AFL-CIO has no right to compete with its member unions in representation elections. And the metal trades department, headed by James A. Brownlow, is not of a mind to give up the practice.

IN THE WINGS—JAMES R. HOFFA: If the AFL-CIO split comes about, the powerful Teamsters Union is on hand to pick up the pieces. In this case, it would be those important craft unions—the laborers, carpenters and plumbers. Already close to the Teamsters union on construction projects, these key craft unions would find a warm welcome in Teamster president Hoffa's territory. The Teamsters, ousted by the AFL-CIO in late 1955, are looking for friends in the labor movement. A team-up with Hoffa would mean a rival labor organization of more than 3-million members, compared with the AFL-CIO's 10-million. But a Teamster-craft alliance would be more powerful than the numbers show. It could effectively control union construction. This Teamster pressure keeps the trouble pot boiling within the AFL-CIO. And this time it could be enough to make it boil over.

MARKETS

Copper Up 1c in U.S.; Aluminum Producers Cut Output; Lead Drops 1c

NONFERROUS METAL PRICES dropped slightly in January owing mainly to the decline of 1c lb in lead. Copper, silver and tin were up slightly, but were not changed enough to offset the drop in lead.

Phelps Dodge raised the price it charges for electrolytic copper to 30c delivered to buyers in the U.S. The new price is effective February 2. Kennecott and Anaconda raised effective February 3.

Conditions had been ripe for the increase for weeks. Many analysts had expected it a week earlier—some believe at least two of the three major U.S. producers had seriously considered the change and had been waiting for one of the others to take the lead.

Prices in Europe had gotten out of parity with U.S. prices. London had started the month at about £220 for both prompt and three months metal. By the 21st it was at £230½ settlement and £227½ three months, asked. On January 30, prompt was £241¾ (30.2c) and three months was about ½c lower. Most Chilean copper was sold in Europe at these prices.

Katanga had raised January 13 to 29.025c from 28.125c; on January 27 it was at 29.5c and on January 30 it raised to 29.95c.

The amount received by sellers in the U.S. was much less than the above prices for materials mined outside the U.S. Copper sold to consumers in the U.S. for 29c delivered brought about 28.6c after payment of internal freight. The payment of the 1.7c import duty reduced this to about 26.9c. Sellers of copper mined abroad would receive about 3c a lb less for their copper sold in the U.S. than that they sold in Europe. Cuban copper enters the U.S. duty free and Phillipine copper enters with a small duty. But at times of good business conditions in the U.S. copper has to be imported from other countries. The above price situation has caused the U.S. to be a net exporter of copper. For this reason U.S. stocks of refined copper as shown by the Copper Institute were down to 80,722 short tons at the end of December, less than a month's shipments.

Refined copper stocks had increased in December outside the U.S. This only appeared to be in conflict with the rising prices in Europe. In part the higher prices indicated anticipation of copper shortages and of higher prices in the U.S. But they were also indicative of the rather tight situation in the spot copper market in Europe. Most producers do not sell in the spot market—they sell their copper only on long term contracts. A few enter the spot market occasionally. Most spot copper in Europe is sold by custom smelters, including those in the U.S., and merchants. Stocks held by these sellers were either limited or they had decided prices were going to rise and they therefore held for better prices. The intake of concentrates and scrap by smelters and merchants has been low and their sales have been relatively heavy.

Rioting in the Belgian Congo, though it has not posed an immediate threat to copper production and probably none to copper shipments, still has the possibility of spreading. There are rumors of nervousness among white employees in the Congo. The threat of a strike at Anaconda's Potrerillos operation in Chile also had some effect.

The conditions that brought about this price increase in the U.S. are not ended. Unless European prices fall they will remain out of equilibrium with the U.S. price and if demand for copper in the U.S. continues to improve the increasing output may not meet the country's needs. It may then have to import significant amounts of metal. The U.S. custom smelters preceded the producers to 30c. At present prices in Europe they will be able to sell all their metal without cutting the 30c price; they may raise ½c or even more.

The upper limit on the U.S. producer price is unknown, probably even to themselves.

Total foreign sales of copper reported to E&MJ in January were up about 10,000 tons from December. U.S. sales were a few thousand tons under December and about equal to November.

Lead was dropped to 12c New York January 22 by American Metal Climax. The other U.S. sellers followed. American Metal said it was "forced to reduce by the actions of U.S. Government agencies in connection with the so-called barter program and by the unrealistic differential between the foreign and domestic prices." Barter business had been disappointing. Only three barters of significance had been done in lead. The bartering agency, the Commodity Credit Corporation, paid, in effect in its agriculture surplus, for the metal on a two price basis. If the material were refined outside the U.S. foreign prices were used in negotiating the price it would pay. For material refined in the U.S. the U.S. price was used. Some suggest the world pricing structure was at fault rather than the CCC.

Imported metal had been sold to consumers at about 11.8c on docks; at the time the major sellers dropped it was a little weaker than it had been in previous weeks.

The drop of 1c in N.Y. had almost no effect on the London price. Other sellers said the situation had been ripe for a price drop—even the import quotas could not maintain the 4c differential indefinitely.

Aluminum markets are weak. Three major producers are cutting output. (Total output was up in December largely reflecting production by new firms.) Alcan took the lead and announced it would cut-back 10% to 500,000 tons per year. Alcoa in mid-January said it was cutting out one potline in Tennessee. It indicated it did not want to pay the higher power cost necessary there at the present time. Analysts wondered about this. Aluminum production costs about 15c a pound, some may cost 16c. The higher power cost cannot add more than 1½c to this so observers wondered why the company would cut back output when it is still so profitable—pig is now priced at 24.7c. Many feel the company did not want to accumulate aluminum at these prices. Kaiser announced late in January it would shut down a second of its eight lines at Mead, Washington on February 1. Accumulating inventories of metal were responsible for the cut-back. Kaiser had reduced earlier its fabricating activity at its Trentwood, Washington, plant.

Imported European aluminum has been selling at about 1½c under the U.S. price; some sales have probably been made at even lower prices. But some factors say these low prices are being met by U.S. producers. There are three main devices in use. One of these is through the "freight allowed" procedure in which a fabricators' trucks returning empty form a distant delivery will pick up primary metal from a producer's shipping point. The trucks rather than returning empty will carry a full load but the cost will be almost zero—but the seller will "return" the full freight charge. Sometimes shipment by barge will provide a good saving also. Some sellers are reported offering 90 days payment which at 6% is worth about $7.50 a ton; importers want immediate payment. Some producers are also reported offering premiums for scrap from fabricators.

Zinc prices are steady. Sales of both Prime Western and Special High have been good. Sales reported to *E&MJ* for calculating weighted average prices in January were about 8,000 tons more than in December. They were considerably under September, October and November. Total shipments in December as shown by the American Zinc Institute were 77,010 short tons, down about 5,500 from November and up about 10,000 tons from the 1958 average.

Change In E&MJ Copper Averages

THE CHANGES in the *E&MJ* copper quotations discussed here last month were made effective January 2, 1959, the first business day of the year. The differential between the export f.o.b. refinery and the c.i.f. Continental port quotation is 0.945c a lb. This is the sum of the 0.125c difference between the f.o.b. and f.a.s. pricing basis, and the current 0.82c freight and insurance between the U.S. and Continental ports.

Average Prices January *(E&MJ Quotations)*

Copper:

Electrolytic, domestic refinery	28.636
Electrolytic, export refinery	27.927
Electrolytic, c.i.f. Cont'l ports	28.872

Lead:

Common, New York	12.667
Common, St. Louis	12.467

Silver and sterling exchange:

Silver, New York, per oz.	90.206
Silver, London, pence per oz.	76.250
Sterling Exchange	280.647

Zinc:

Prime, Western, East St. Louis	11.500
Prime, Western, delivered (g)	12.000

Tin:

New York Straits	99.345
Gold, per oz., U. S. price	$35.000
Quicksilver, per flask	$218.000
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$52.000
Cadmium (a)	145.000
Cadmium (b)	145.000
Cadmium (c)	145.000
Aluminum, 99% plus ingot	26.800
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

International gold transactions declined 7½% in January. Prices showed small increases in Paris and the Near East, while rising sharply in the Far East. London was the recipient of small quantities of Soviet gold. Paris was very active and West German transactions were brisk. Trading in India increased and bar gold prices rose to an eight-year high, reaching $60 per oz during the month. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS Dec. 31	COINS Jan. 31	BARS (12.5 kg) Dec. 31	BARS (12.5 kg) Jan. 31
NEW YORK				
transit	.....	.....	$35.08½	$35.08½
MANILA	$42.25	$42.50	36.15	36.15
HONG KONG	45.80	46.65	38.45	38.75
BOMBAY	58.50	61.50	56.50	59.50
TANGIER	40.60	40.20	35.20	35.20
BEIRUT	40.75	41.25	35.23	35.21
PARIS	40.75	39.95	35.75	35.35
BUENOS AIRES	38.00	38.50	37.40	36.45

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of January reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest 1/16c; ¼c deducted for selling common.

Delivered Consumers' plant	29.000 lb
F.o.b. refinery	28.600 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Jan. 1959	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1				Holiday				
2	28.600	26.800	13.000	12.800	12.000	11.500	24.700	98.000
5	28.600	26.825	13.000	12.800	12.000	11.500	24.700	98.250
6	28.600	27.100	13.000	12.800	12.000	11.500	24.700	98.875
7	28.600	27.125	13.000	12.800	12.000	11.500	24.700	99.125
8	28.600	27.200	13.000	12.800	12.000	11.500	24.700	99.000
9	28.600	27.225	13.000	12.800	12.000	11.500	24.700	99.000
12	28.600	27.400	13.000	12.800	12.000	11.500	24.700	99.125
13	28.625	27.925	13.000	12.800	12.000	11.500	24.700	99.000
14	28.600	28.100	13.000	12.800	12.000	11.500	24.700	98.875
15	28.600	28.075	13.000	12.800	12.000	11.500	24.700	98.750
16	28.625	28.225	13.000	12.800	12.000	11.500	24.700	99.125
19	28.625	28.175	13.000	12.800	12.000	11.500	24.700	99.625
20	28.625	27.850	13.000	12.800	12.000	11.500	24.700	99.750
21	28.625	27.950	13.000	12.800	12.000	11.500	24.700	99.750
22	28.650	28.150	12.000	11.800	12.000	11.500	24.700	99.625
23	28.625	28.075	12.000	11.800	12.000	11.500	24.700	99.625
26	28.675	28.250	12.000	11.800	12.000	11.500	24.700	99.625
27	28.675	28.600	12.000	11.800	12.000	11.500	24.700	99.875
28	28.675	29.025	12.000	11.800	12.000	11.500	24.700	100.125
29	28.900	29.075	12.000	11.800	12.000	11.500	24.700	100.500
30	28.625	29.325	12.000	11.800	12.000	11.500	24.700	100.625
AVERAGES FOR MONTH								
Jan.	28.636	27.927	12.667	12.467	12.000	11.500	24.700	99.345
AVERAGES FOR WEEK								
Jan.								
7	28.600	26.963	13.000	12.800	12.000	11.500	24.700	98.563
14	28.605	27.570	13.000	12.800	12.000	11.500	24.700	99.000
21	28.620	28.055	13.000	12.800	12.000	11.500	24.700	99.400
28	28.660	28.420	12.000	11.800	12.000	11.500	24.700	99.775
CALENDAR WEEK AVERAGES								
Jan.								
2	28.600	27.031	13.000	12.800	12.000	11.500	24.700	98.438
9	28.600	27.095	13.000	12.800	12.000	11.500	24.700	98.850
16	28.610	27.945	13.000	12.800	12.000	11.500	24.700	98.975
23	28.630	28.040	12.600	12.400	12.000	11.500	24.700	99.675
30	28.710	28.855	12.000	11.800	12.000	11.500	24.700	100.150

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1			Holiday		
2	No Market	75.875d.	280.3437	250s. 3¼d.	$35.00
5	89.875	75.875d.	280.4375	250s. 1¾d.	35.00
6	89.875	75.875d.	280.4687	250s. ¾d.	35.00
7	90.000	75.875d.	280.5312	250s. 1d.	35.00
8	90.125	76.000d.	280.5750	249s. 11¾d.	35.00
9	90.125	76.125d.	280.4375	250s. ¼d.	35.00
12	90.125	76.125d.	280.5000	249s. 11½d.	35.00
13	90.125	76.125d.	280.4875	249s. 10¾d.	35.00
14	90.125	76.125d.	280.5000	249s. 11½d.	35.00
15	90.125	76.125d.	280.5625	249s. 11½d.	35.00
16	90.125	76.125d.	280.6250	249s. 10¾d.	35.00
19	90.125	76.125d.	280.6875	250s. 0d.	35.00
20	90.375	76.125d.	280.6875	250s. ¼d.	35.00
21	90.375	76.375d.	280.6875	249s. 11¼d.	35.00
22	90.375	76.625d.	280.7187	249s. 11¼d.	35.00
23	90.375	76.625d.	280.8437	249s. 9½d.	35.00
26	90.375	76.625d.	280.9375	249s. 7½d.	35.00
27	90.375	76.625d.	280.9375	249s. 6¾d.	35.00
28	90.375	76.625d.	280.8437	249s. 7¾d.	35.00
29	90.375	76.625d.	280.8937	249s. 6¾d.	35.00
30	90.375	76.625d.	280.8750	249s. 6d.	35.00
AVERAGES FOR MONTH					
Jan.	90.206	76.250d.	280.647	—	35.00
AVERAGES FOR WEEK					
Jan.					
7	89.917	—	—	—	35.00
14	90.125	—	280.500	—	35.00
21	90.225	—	280.650	—	35.00
28	90.375	—	280.856	—	35.00

Calendar Week Averages: New York Silver: Jan. 2, 89.875; 9, 90.000; 16, 90.125; 23, 90.325; 30, 90.375.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Jan.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	Holiday															
2	220¼	220½	219¾	220	72¾	73	72¾	73	75¼	75½	73	73¼	744½	745½	747	747½
5	220¾	221	220¼	220½	73⅛	73½	73	73¼	75½	75⅝	73	73⅛	747	747½	749	749½
6	222½	222¾	222	222¼	73½	73⅝	73¼	73⅜	76	76¼	73⅝	73⅝	754	755	755	756
7	224½	224¾	223¾	224	73⅝	73½	73	73¼	75½	76	73	73½	756½	757	757½	758
8	222½	222¾	221¾	222	72¾	73	72¾	73	75	75¼	72½	72¾	755	756	757	757½
9	224¼	224¾	223¼	223½	72½	72¾	72½	72¾	75½	75⅝	73	73¼	756	757	757½	758
12	228¾	228½	226½	226¾	72½	72⅝	72¾	72½	76	76¼	73¼	73½	757½	758	758½	759
13	229½	230	227½	227¾	72⅝	72½	72½	72¾	76¼	76½	73¾	74	756	756½	756½	757
14	231¼	231½	228	228½	72	72½	72¾	72½	76¾	76⅝	73½	73⅝	755½	756	756½	757
15	229	229½	226	226¼	70	70¼	71½	71⅝	75¼	75½	73¼	73½	756	756½	757	757½
16	231½	231¾	227½	227¾	71½	71⅝	71⅝	72	75¾	75½	73½	73¾	757½	758	758½	759
19	230¾	231	227½	227⅝	71½	71⅝	71½	72	75¼	75½	73¼	73⅝	760	761	760	761
20	228½	228¾	225½	225¾	71¼	71½	71½	71¾	75	75¼	73	73¼	762½	763	763	763½
21	230¼	230½	227¼	227½	71⅜	71¾	71½	72	74¾	74½	73¼	73½	763	763½	762½	763
22	231¼	231½	227¾	228	71	71⅜	71¼	71⅝	74½	74⅝	73	73¼	764	765	762	762½
23	230½	230¾	227	227¼	70¼	70⅜	70¾	70½	72¾	73	71¾	72	761½	763	761	762
26	234¼	234½	229¾	230	70⅛	71	71¼	71⅜	72½	72¾	71¼	71½	761	762	761½	762
27	238	238½	233¼	233½	71¼	71½	71½	72	73	73¼	72	72½	763	763½	762½	763½
28	239½	240	234	234½	70⅛	71	71⅝	71¾	73½	73⅝	72	72¼	764	765	764	764½
29	240¼	240½	235	235¼	71	71⅛	71¾	71⅞	73½	73⅝	72¼	72¾	765½	766	765	765½
30	241½	241¾	237	237½	70¼	71	71¾	71¼	73¼	73½	72¼	72½	766½	767	766	767
Av'g's	£230.101		£227.292		£71.851		£72.164		£74.884		£72.932		£758.774		£759.238	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

January 31, 1959

Aluminum ingot, 99 plus % lb.		26.8¢
Antimony, spot, lb., less than carload, in cases		32.59¢
In bulk, carload lots, f.o.b. Laredo		29.00¢
Imported, 10 ton min. (p), 99½%		24¢
Bismuth, ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.45
Calcium, lb., ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb., contract del.		$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957		$2.00
Germanium, per gram, 10,000 gram lots	(c)37¢ —	(d)40.2¢
Indium, troy oz.	$1.25 @	$2.25
Lithium, lb., 98%	$9.00 @	$11.00
Nickel, cathodes, lb. (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.		74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16		35¼¢
Palladium, troy oz.	$15.00 @	$17.00
Platinum (wholesale lots), troy oz.	$51 @	$55
Quicksilver flask of 76 lb. 25 flasks or more	$218 @	$223
Selenium, 99 plus %, lb.—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		21½¢
Semi Conductor grade, lb.		$350
Tellurium, lb.		$1.65
Thallium, 100 lb. or more lb.		$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62 @	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	(a)$28 @	(a)$31
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$19 @	$20
48% Cr_2O_3 3 to 1 ratio	$40 @	$42
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi, non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra, $.915 @ $.965. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.05 @	$1.10
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra		$12.00
U. S. scheelite, f.o.b. mill	$20 @	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton		$68

(a) Nominal.
(e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5¾¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb. eff. Oct. 24, '58		$11.65
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46 @	$1.47
Imported, incl. 37¢ duty	$1.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50 @	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)		14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovanadium, per lb. of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,400 @	$1,810
Crude No. 2	$750 @	$1,155
Spinning fibers	$370 @	$600
Shingle fibers	$180 @	$220
Paper stock	$120 @	$145
Waste	$75 @	$86
Shorts	$40 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$220 @	$787
Asbestos, Vermont, f.o.b. Morrisville:		
Spinning fibers	$370 @	$428
Shingle stock	$181 @	$200
Paper stock	$120 @	$152
Waste, stucco or plaster		$86
Refuse or Shorts	$41 @	$75
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00 @	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap, $20 @ $30.

Ocher, Georgia, ton in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30 @	$5.50

LOOK–they're interconnectable!

O-B "cap screw" cable connectors

you can connect this...

- to any other single conductor cable
- either copper or aluminum
- from 4/0 to 1,590,000 CM
- same size or different size
- straight-thru, tap-off, or three-way
- simply by tightening two cap screws!

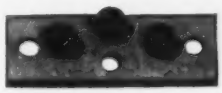
When you leave one of these O-B connector halves semi-permanently attached to the ends of your cable, you can make any of the above connections in a minute or two simply by tightening two cap screws. All connectors have ample strength, current-carrying capacity equal to or exceeding that of the cables themselves. Smooth, slim contours tape easily, drag over rough bottom without snagging. Ask your local O-B representative or write us today for more information.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

Straight-Thru Connector



Three-Way Plate

Tee Connector

4829-M

AC and DC

Westinghouse motors are job-proved for all mining applications

Regardless of whether you need a-c or d-c motors . . . regardless of the particular application . . . you'll find there's a Westinghouse motor to do the job . . . a motor which has proved itself time and again for rugged dependability and long operating life.

Combining the most modern materials with proven dependability and durability, Westinghouse motors will help you increase production through more efficient service . . . will help you decrease capital investment by giving you many extra years of reliable performance.

Westinghouse motors . . . either a-c or d-c . . . are available in all ratings, mountings, enclosures . . . standard or special design. Prompt delivery is backed by expert application and service-engineering assistance.

For complete information, contact your nearby Westinghouse representative. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J-22120

YOU CAN BE SURE...IF IT'S Westinghouse

CATERPILLAR'S
PROJECT
PAYDIRT

PROJECT PAYDIRT *pays off for you*

NEW CAT D8

PUSHLOADING: PRODUCTION UP

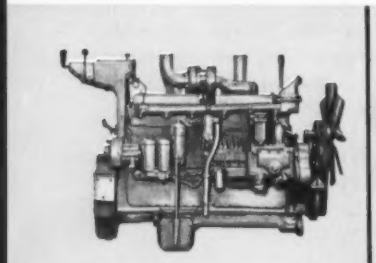
The new Caterpillar D8 Series H Tractor is ready *now* to increase its lead as undisputed king of its size class. A major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box), the new D8 has been proved through a rigorous field testing program.

This D8 is new in design, appearance and performance. It is bigger, more powerful. It incorporates new engineering advances. It is easier to operate.

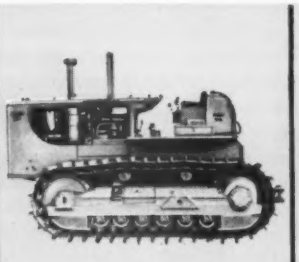
Now—what can it do for you? Here's the answer:

The D8 has been thoroughly field tested on actual jobs. Several of the big new tractors have been at work constantly in every kind of material. Out of the statistics developed, both pushloading and bulldozing production figures are *up*.

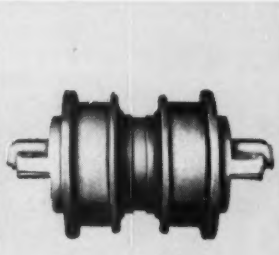
This means that you can move dirt faster and cheaper than ever before with a tractor in this size class. You



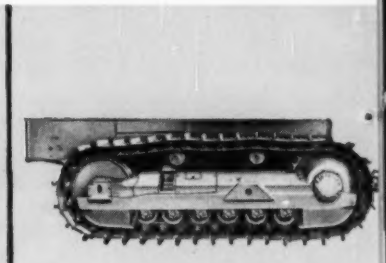
HORSEPOWER INCREASED 18%. The horsepower of the new D8 is up from 191 to 225 at the flywheel, from 155 to 180 at the drawbar. In addition, engine torque rise now is 20%, an increase of one-third. Over-all engine performance has been greatly improved by the addition of a turbocharger.



SIZE INCREASED. To make effective use of the new horsepower, over-all weight of the tractor has been increased 4,400 lb. to a total of 47,000 lb. At the same time the gauge has been increased to 84 inches, track on ground lengthened to 114 inches, square inches of contact increased to 5,505.

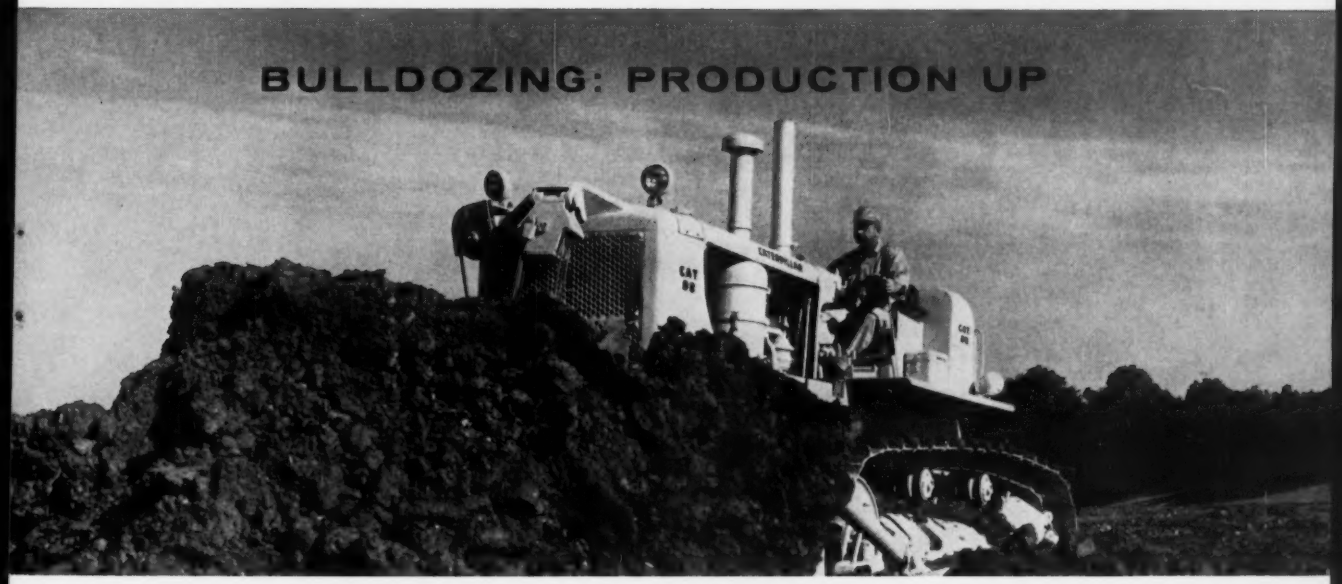


LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



NEW, STRONGER, HEAVIER UNDERCARRIAGE. Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And ground clearance has been increased 50% to almost 20 inches.

SERIES H TRACTOR



get higher production, bigger profits—yet the new D8 is actually *more economical* to own and operate!

But find out for yourself. Get the full story from your Caterpillar Dealer, all the eye-opening facts and figures that can only be touched on briefly here. Then *see* this great new machine at work on your operation as soon as possible. You can't afford not to!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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BORN IN RESEARCH... TESTED IN THE FIELD

DRY-TYPE AIR CLEANER. Here's still another major Caterpillar research development on the new D8—the new dry-type cleaner which removes 99.8% of dirt in the intake air, even under severe operating conditions. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.

SUPERIOR OPERATION. Operator visibility is excellent because of higher deck and changed seat position. Console-type controls make operator's job easier. And on torque converter models, standard foot-operated decelerator can override hand throttle—free operator's hands for other controls.

TWO MORE IMPORTANT OPERATOR CONVENIENCES

HIGHER SPEED. Completely new, long-life, direct drive transmission provides six speeds forward and six reverse. High speed has been increased to 6.3 MPH forward, 6.4 reverse to reduce cycle time. Operator can shift from any forward gear into a similar reverse gear (or vice versa) by simply moving the forward-reverse lever.

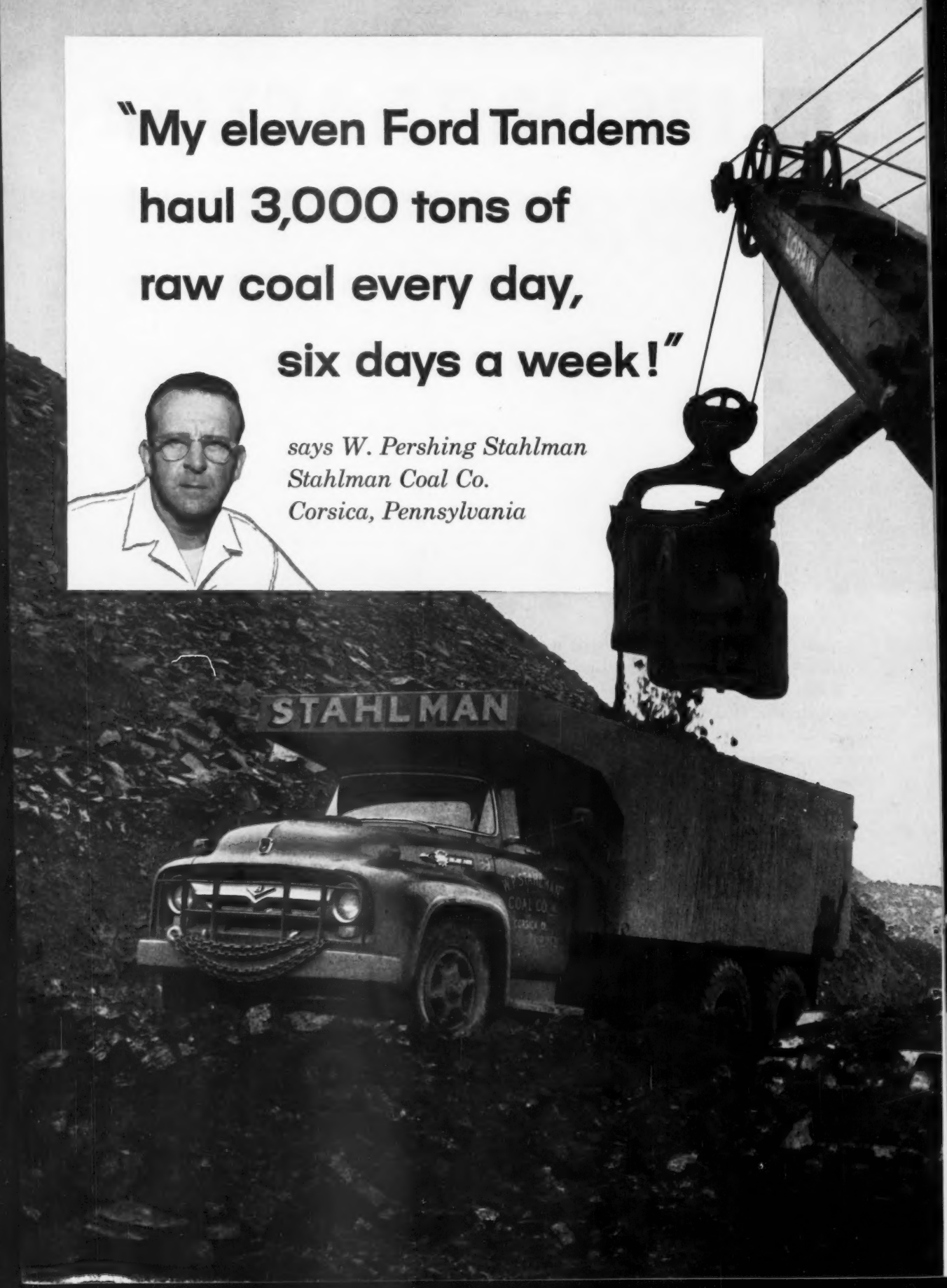
DEPENDABLE OIL CLUTCH. By contractor and operator demands, the virtually service-free, easy-to-operate oil clutch has been retained in the new D8. Another important Caterpillar exclusive.

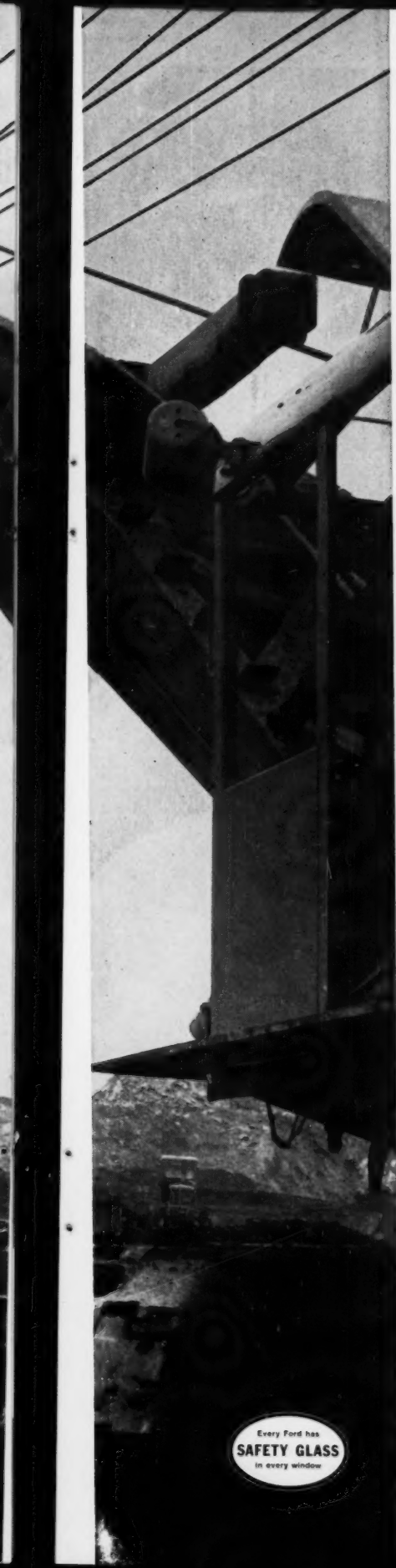
CATERPILLAR'S **PROJECT PAYDIRT**

PROJECT PAYDIRT: Caterpillar's multi-million-dollar research program—to meet the coming challenge of the greatest construction era in history with the highest production earth-moving machines ever developed.

"My eleven Ford Tandems haul 3,000 tons of raw coal every day, six days a week!"

says W. Pershing Stahlman
Stahlman Coal Co.
Corsica, Pennsylvania





"I can't afford unreliable equipment. And rough going doesn't bother my Fords. Many have over 200,000 miles on 'em!

"My Ford tandem fleet hauls raw coal from three strip mines to the washing plant and loading bins. Working 10,000 acres, and feeding one of the largest washing plants in the country calls for super-dependable trucks. They must climb steep grades coming out of the pits with 18-ton payloads. It's a tough operation, requiring lots of brute power and stamina. Ford Heavies really do the job, and with a minimum of expense.

"Power steering is a wonderful Ford tandem feature. My drivers like the handling ease it gives on mud and shale roads.

"22 years of experience in the trucking business has taught me the value of Fords. And I've got 2 new '59 Ford T-800's on order."

Go Ford-ward for savings with '59 Ford Trucks!

NEW FORD 4-WHEEL DRIVE PICKUPS are excellent personnel and equipment carriers for punishing off-road and mining operations.

Whatever your job . . . wherever you do it—you'll find Ford Heavies and Extra Heavies are engineered and built to do it better! And the '59 improvements in these models give you still more benefits.

Factory installed tractor package custom-fitted to Ford trucks for safer, more dependable braking.

New internal shoe parking brake has nearly 50% greater stopping and holding ability, requires less than half the operating effort needed for previously used type.

Higher payloads and longer axle life with new, higher capacity front and rear axle options.

Greater operating economy with faster axle ratios and wider choice of transmissions.

Yes, the new '59 Ford trucks are here to take you *Ford*-ward for savings, *Ford*-ward for modern style and stamina. See your Ford Dealer today!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

JOB RECORDS PROVE

New Firestone Super Rock Grip Deep Tread slashes mining haul costs!

Firestone's new Super Rock Grip Deep Tread tire is setting long-wear records on the toughest hauls in the roughest terrain! The non-directional super tread is 50% deeper and has a thicker base compounded with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires. This all-new tread design spaces massive traction bars for top traction and better body protection. And with 50% more non-skid tread, operators report double the hours of original tread service! Extra-heavy sidewall construction is your best insurance against cuts and snags. The cord body is built with extra plies of Firestone S/F (Shock-Fortified) cord for reserve strength, longer life and more retreads. Ask your Firestone Dealer or Store about these tubeless or tubed heavy-duty Super Rock Grip Deep Tread tires today.

Super Rock Grip Deep Tread

Firestone

BETTER RUBBER FROM START TO FINISH

When ordering new equipment always specify Firestone tires.

Enjoy the Voice of Firestone on ABC television every Monday evening.

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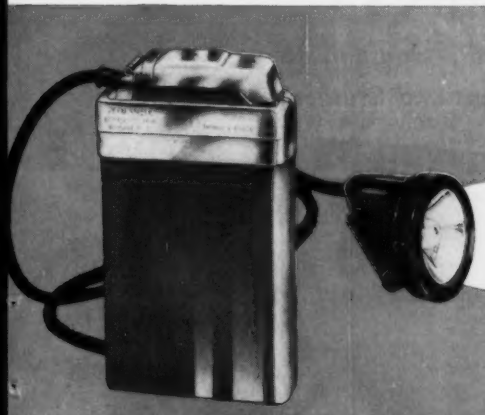
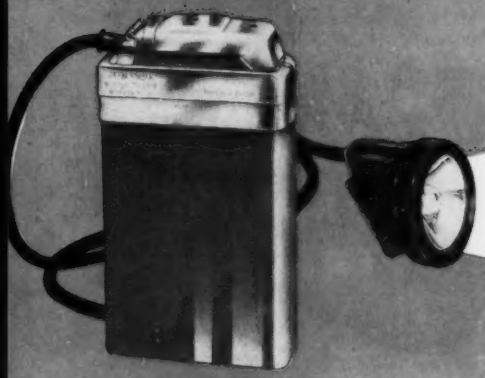
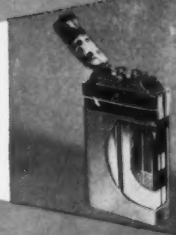
You can depend on the EDISON R-4's brilliant, unfailing light...



The Bulb's reserve filament means continued, full light

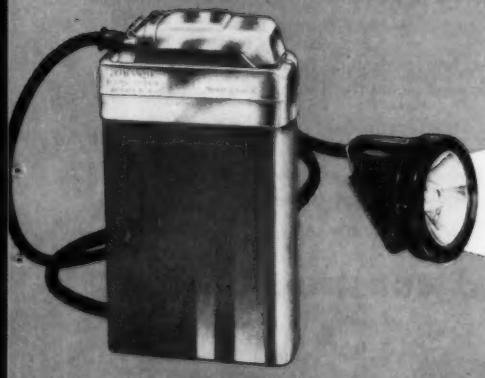
See the double filament in the bulb? It's your proved protection against lost time for the miner, and a short crew for the foreman. If one filament burns out, a turn of the switch restores continued, brilliant, full illumination—*working light*, not just emergency light!





The battery that doesn't fail on the job

Because light is only as dependable as the battery that provides the power, battery service life is the only answer to performance. The Edison R-4 Battery does not destroy itself to function, does not deteriorate when not in use. You get the most dependable light, shift-after-shift, for years.



The M.S.A. Service Engineer makes your lighting his business

Your Edison lamp installation—Self-Service, Standard or Modified—is the responsibility of a trained M.S.A. Service Engineer. His planned system of return calls insures your receipt of the maximum service from your lamps. You benefit from this responsible know-how in peak lamp performance, more efficient and economical lamphouse procedure.

MSA
SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M.S.A. is at your service ... our job is to help you

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 76 Branch Offices in the United States
MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg
MINE SAFETY APPLIANCES CO. de MEXICO, S. A. de C. V.
Mexico 4, D. F., Mexico

These Edison R-4 QUALITY features, and service, give you that *extra* illumination that lets you realize every production advantage from today's mechanized equipment. Let us show you how this vital mining tool can help fill the gap between average and peak production with greater safety. Write for details.

HEAVY-DUTY
HYDRASTROKE* FEEDER
FOR MINES and MILLS

A Reciprocating High-Tonnage Feeder easily adapted to feed Belts, Trucks, Skips, Railroad Cars, Screens and Crushers

PATENT APPLIED FOR

Exclusive HYDRAULIC OPERATION

Check these Outstanding Advantages

☐ **HYDRAULIC OPERATION**

Exclusive hydraulic power drive supplies the fluid to a cylinder which reciprocates the deck. Fixed or variable feeding rates are easily available through the use of a fixed or a variable volume pump. Length of stroke can be varied from 6 to 24 inches.

☐ **MINIMUM HEAD ROOM**

Head room requirements are reduced to as little as 20 inches. Impact damage is minimized because discharge lip of feeder is only 6 to 8 inches above lowest clearance line of feeder. Initial construction costs are reduced.

☐ **ROCKER MOUNTING OR SUSPENSION**

May be installed with either rocker suspension or self-contained rocker mounted units. Eliminates costly wear due to friction which is present in other types of feeders. No lubrication is needed. Feeder can take severe shock loading.

Durability characterized by special rugged construction

Wide range of sizes available . . . widths from 36" to 96" . . . feeding capacities from 300 to 7500 tons per hour.

Write for illustrated brochure.

NICO *TRADEMARK

NATIONAL IRON COMPANY

50th Avenue West and Ramsey Street Duluth 7, Minnesota

Subsidiary of Pettibone Mulliken Corp., Chicago 51, Illinois

Mexico 4, D. F., Mexico

Write for details.

New, low-cost way to improve haul roads

There is new emphasis, these days, on road-maintenance in mines and quarries. Many pits now use blading equipment full-time on haul routes. Others are hard-surfacing their roads. Reason: auto and tire makers have proved that maintenance costs far less than slow hauling, excess tire wear, and equipment breakdowns caused by poor roads. Good haul surfaces boost production, lower equipment up-keep costs.

You can keep haul roads smooth, fast, safe, *at rock-bottom cost*... with no "extra" equipment, no more man-hours than you're now paying for, and no new personnel. Next time you replace a crawler-tractor, replace it with *rubber-tired* Tournatractor®. This LeTourneau-Westinghouse machine will handle all the work of the rig you trade in, and, because of its extra speed, take on a regular road-maintenance program as a "bonus" service.

Instant-shift, positive brakes, and electric blade control, plus speeds to 17.2 mph, make Tournatractor a fast worker. It's rugged, too. And, in a few minutes, it can leave its regular assignment and run, at 17.2 mph, to dig a drainage ditch, smooth a rutted road, clean silt off a bench, tidy up a stockpile, or do other tractor work. This "extra" service costs you nothing in added investment, operating cost or added personnel.

Move it anywhere . . . profitably

Key to this "double duty" ability is the fact that, unlike crawlers, Tournatractor is not "tied down" to one location, or one job, in your pit. Because it travels at 17.2 mph, you can move it around at will . . . easily, quickly, efficiently. Tournatractor can often leave its "regular" job, get to any part of your road system in a few minutes, do a quick maintenance job, and return to its normal assignments before it is missed.

Trying the same plan with a track-rig rarely works. First of all, you seldom can spare the time a crawler needs to get anywhere. And if you *do* have time, the 5-to-6 mph crawler spends most of it just traveling. Also, scheduling a crawler on a 4 or 5 mile per day travel circuit costs plenty in track wear and repairs.

Time for roadwork easy to find

Finding time for Tournatractor's roadwork is easy. This high-speed unit can clean up at several shovels, still find time to do roadwork — plus other plant and stockpile clean-up — in-between clean-up sessions along the working face. Many pits have found that just one Tournatractor can replace two or three crawlers and handle *all* "miscellaneous" grading and pulling jobs as well as shovel clean-up.

For all its mobility and speed, Tournatractor is a hard worker, too. Massively, ruggedly built, it offers 210 hp . . . delivered through an anti-friction drive and torque converter to four, wide, low-pressure tires . . . for positive traction on any surface.

Let us send you complete details on how "go anywhere" Tournatractor can easily handle road maintenance in your pit at no extra cost.

CT-1647-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

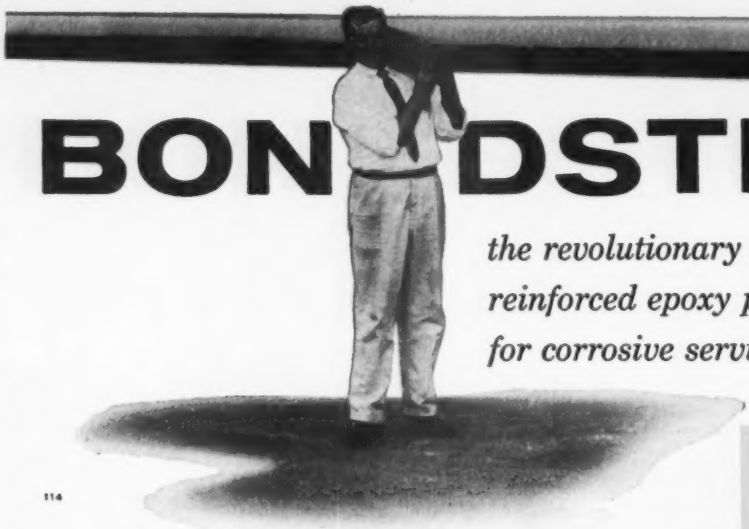
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

STRONG as steel pipe

...at one-eighth the weight!

Circumferential Tensile Strength ... 80,000 psi



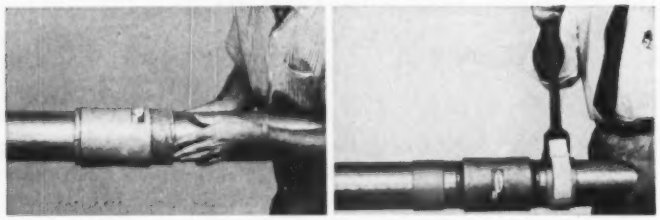
BONDSTRAND®

the revolutionary fiber glass reinforced epoxy pipe for corrosive service

114

Here's a pipe that holds up indefinitely under the corrosive action of many salt, acid and alkaline solutions ... that can't contaminate or flavor the piped material ... that is rigid enough to resist sag, cold flow or deformation – flexible enough to follow normal ditch contours ... that remains smooth and unclogged throughout its entire service life ... that won't leak, even near its burst pressure.

Easy to install, with choice of locking wedge or threaded fittings.



Simple instructions with each shipment insure a perfect joint on the first try.

IN THE MINING INDUSTRY...

Because BONDSTRAND pipe is light in weight, nonconductive, nonsparkling and corrosion resistant inside and out, it is ideally suited for mining operations. It is suggested for lines carrying fresh water, mine water and compressed air; and for air ducts, especially where oxidized sulfides are involved. Other uses include transport lines in plants which chemically treat ore, and pumping lines between leaching tanks, clarifiers, precipitation tanks and similar equipment.

Amercoat® CORPORATION

Dept. UB • 4809 Firestone Boulevard • South Gate, California

921 Pitner Avenue, Evanston, Illinois
360 Carnegie Avenue, Kenilworth, New Jersey
2404 Dennis Street, Jacksonville, Florida
6530 Supply Row, Houston, Texas

A Subsidiary of American Pipe & Construction Company

Adverse haul conditions reducing your output?

Put your hauling operation on a high-production basis — despite restricted areas, rough winding roads, or bad weather conditions — with rugged LeTourneau-Westinghouse Tournapull® Rear-Dumps. Here's how these pivot-steer haulers can cut minutes off your haul cycles.

Speeds loading — Because the Tournapull prime-mover pivots 90° right or left, you can place L-W Rear-Dumps under the shovel *quick*. Low, wide bowl-opening gives shovel operator big, easy target . . . cuts spillage. Production delay for clean-up of pit-floor is minimized. Three-layer, all-steel bowl floor withstands pounding of heavy rocks. Sloping sides deflect load shock, cushion floor area with layer of material.

Hauls anywhere — Equipped with exclusive power-transfer differential, L-W Rear-Dump keeps load moving steadily through mud and slippery footing, over uneven ground, and around sharp turns. Big, low-pressure tires give top flotation — low center of gravity assures stability on uneven terrain.

Dumps quick, clean — Flick of switch on control panel instantly activates point-of-action electric hoist-motor. Body raises quickly, to desired angle. At full-dump position, edge of bowl is low behind rear wheels. Material dumps clean. It cannot roll forward to lodge against wheels, nor pile under rear end. Streamlined body sheds stickiest material readily.

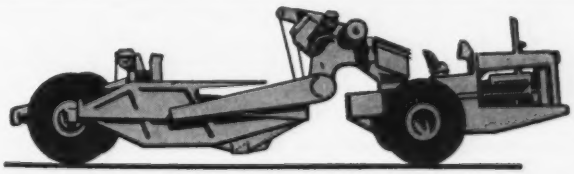
Safe, effortless control — Both dumping and steering are actuated by a quick, simple finger-tip movement on electric switches. Giant air brakes — combined with Electrotarder, for auxiliary non-wear fly-wheel brake power — add safety.

Maintenance is low, because highly-simplified L-W Rear-Dumps eliminate so many vulnerable parts that cause trouble on conventional haulers. All-welded, reinforced steel bowl resists toughest wear and shock.

Compare its performance

Let us demonstrate a haul-anywhere L-W Rear-Dump at your pit. Compare its time-saving performance against your present haulers. Select from 3 sizes: 11, 22, and 35 tons. Call or write for complete information.

R-1862-MQ-1



Converts to easy-loading scraper

When rock-hauling work is completed, you can interchange the L-W Rear-Dump trail-unit with an easy-loading scraper, behind the basic Tournapull prime-mover. You'll then have a double-duty tool for stripping and roadbuilding — or to rent out profitably for all types of earthmoving projects. Scraper is available for about ¼ the cost of complete original L-W Rear-Dump. Other specialized trail-units to increase prime-mover's usefulness also available.

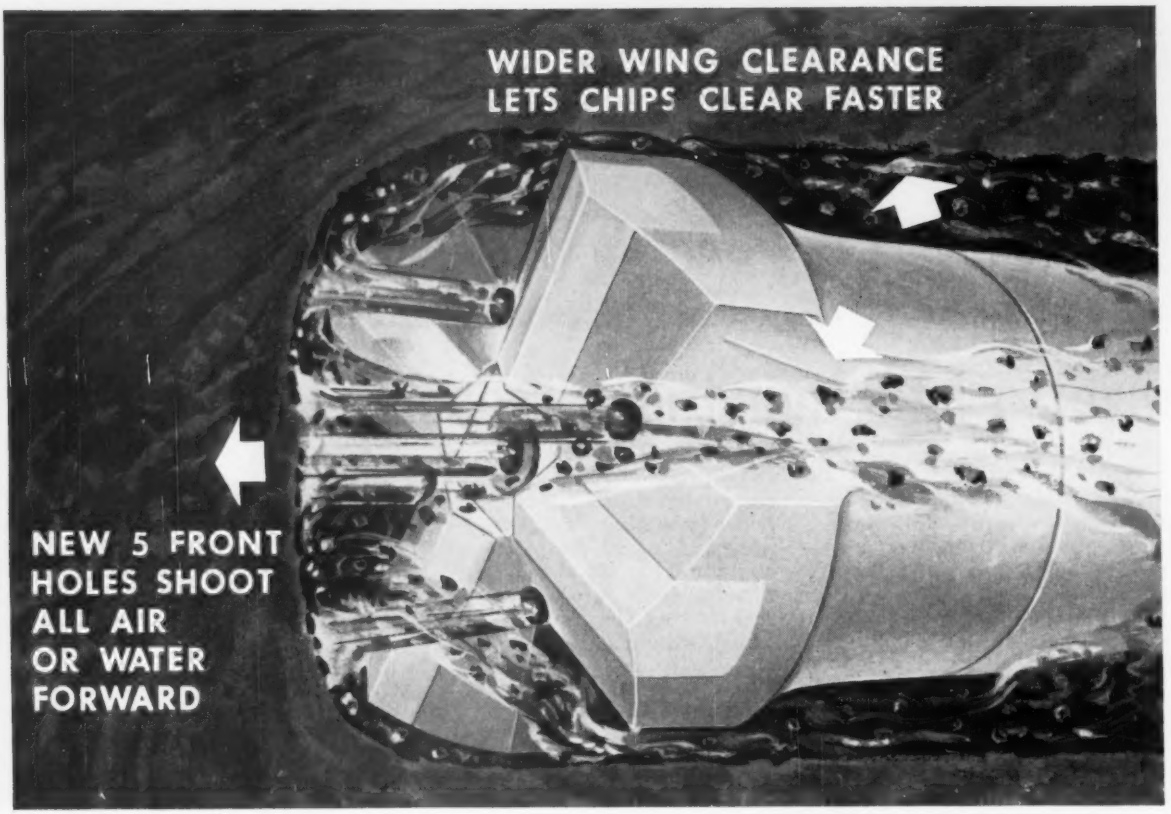
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

For drifters, sinkers and stopers...

New TIMKEN® threaded bit spends less time "drilling" chips, more time drilling rock

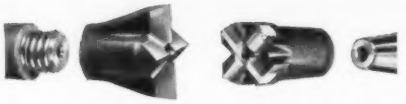


The diagram above shows how the new Timken® threaded carbide bit spends less time "drilling" chips and more time drilling rock—gives you more hole-per-bit. That's because 1) the new Timken threaded carbide bit's newly positioned 5 front holes direct all air or water with jet-action against the rock face and 2) the deeper, wider wing clearance lets chips clear faster. And the deeper relief under the heel allows even more clearance for washed-back chips. This speedier chip removal ends the problem of clogged drill steels and protects bit skirts against damage.

You save even more because new special analysis carbides in the new Timken threaded bit give it greater wear-resistance with added shock-resistance. They can be reconditioned many times. The redesigned heavier wing helps drilling go faster. And the improved thread contact cuts breakage to the lowest point.

For more hole-per-bit on drifters, sinkers and stopers, use the new Timken threaded carbide bit. Write for free brochure that gives all details. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

FOR OTHER TOUGH DRILLING JOBS



IMPROVED TIMKEN MULTI-USE BIT

with correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel can be drilled.

NEW TIMKEN TAPERED SOCKET BIT

The air-leg bit of the future—here today! Removable for full steel life. Tapered for more secure union. Same new frontal features as threaded bit.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

REMOVABLE ROCK BITS

A sure way to "lower the boom" on your stripping costs

Building new haul road at Kentucky pit, modern B Tournapulls with 27-yd Fullpak scrapers heap big loads of sticky clay fast. Machines' excellent maneuverability in the cut and on the fill, plus high travel speed permited faster cycles... helped lower production costs.

When stripping overburden, building haul roads, or leveling sites for camps or drill set-ups — fast, high-production earthmovers can play an important part in keeping your costs down. That's why so many pit owners rely on LeTourneau-Westinghouse Tournapull® scrapers. These versatile machines heap big loads quickly, haul anywhere, and spread fast. Here are 4 big reasons why:

1. Most power used for cutting

When loading, Fullpak® scraper wheels ride inside cutting width... hold flat-bottom bowl low (1° flow angle on 27-yd B Fullpak). Dirt slides in easily, almost horizontally. With bulk of power used for cutting — little for bulldozing against high-angled blade — scraper heaps big loads fast. With blade location and bowl shape designed for easy, fast-flow loading, Fullpaks pack in the last yard almost as easily as the first.

2. Easy loading in tough conditions

High apron-lift permits fast loading and unloading of chunky materials. Quick-release clutch on hoist-motor lets your operator rapidly "pump" bowl up and down... helps get big loads in loose dead-flowing material. Streamlined bowl construction makes it easy to load next to vertical banks and around obstructions.

3. Poor footing no barrier

When working Tournapull scrapers, there's little need for weather shutdown, nor to extend your haul distance to bypass mud, sand, and soft going. Prime-mover has an exclusive power-transfer differential that automatically slows spinning wheel and transfers up to 4 times the power to wheel on firmest footing. The L-W differential works *continuously* — on turns, through mud and slippery footing, over rough, uneven ground. This gives you better traction throughout any haul cycle... for faster, easier, low-cost stripping, roadbuilding, or other dirtmoving.

4. Unloads all material fast

Scraper's positive-ejection tailgate moves straight forward with full power on the thrust. There's no need to lift the load. Tailgate has plenty of power to force out sticky clay, mud, rocks — wipes bowl clean in a single pass. Inside of bowl is cleanly designed, with no angular obstructions to block material flow. Return of tailgate is by electric power — there are no troublesome springs.

Try one at your pit

Put a modern LeTourneau-Westinghouse Tournapull scraper to work in your pit. Use it on any dirtmoving job you wish — stripping overburden, cutting drainage ditches or sluiceways, stockpiling, refilling, landscaping, etc. Check production, check costs! You'll find these units complete cycles faster ... give you higher production at low cost. 3 scraper sizes with capacities of 9, 18, and 27 yd — diesel-powered 2-wheel prime-movers with 138, 210, 300- or-335 hp. Call for full details.

Convert dirtmover to rugged rock-hauler

For less than ¼ of the cost of the Tournapull with scraper, you can add a Rear-Dump trail-unit to interchange with original scraper behind same prime-mover. In dump position, as shown, 35-ton B Rear-Dump makes continuous 180° turn in just 27 ft — in travel position, 35 ft. Rear-Dump's all-steel body with tri-layer bottom withstands the pounding of heavy rock. Unit dumps smooth and clean over the edge of the bank... hauls anywhere. Other trail-units to increase prime-mover's usefulness also available.

P-1835-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

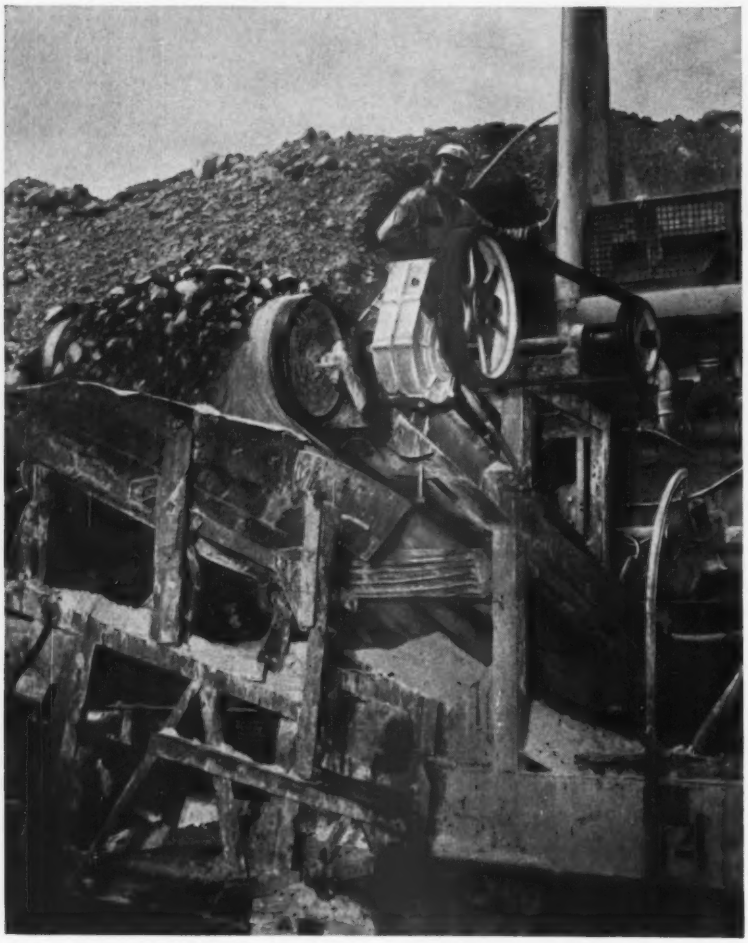
Where quality is a habit

ENGINEER'S FIELD REPORT

PRODUCT **CHEVRON STARTING FLUID**

FIRM **GIBBONS & REED CO.**
Salt Lake City, Utah

Assures fast starts every time—even at -30°



Using Chevron Starting Fluid for its trucks, construction equipment and stationary engines, Gibbons & Reed Co. gets the fast, sure starts necessary to keep its men and equipment working in severe winter weather. Firm's master mechanic, Marv Carlisle, (above) says, "It kicks over the Cummins HR-600 on this crushing unit in a matter of seconds—even at 30° below zero! It saves batteries, gets our equipment started when we need it. Chevron Starting Fluid is a real necessity around a construction job in cold weather. We wouldn't be without it!"

Gibbons & Reed Co., a large general contractor specializing in highway and airport runway construction, tunnel building and general paving work, has used Chevron Starting Fluid since 1948—currently uses it on 300 engines. With jobs throughout the Western States, frequently with completion date penalty clauses, firm finds it indispensable five months of the year. For only a few cents per start, Chevron Starting Fluid helps keep jobs on schedule, and removes risk of idle men and equipment when engines fail to start promptly.

CHEVRON STARTING FLUID

TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

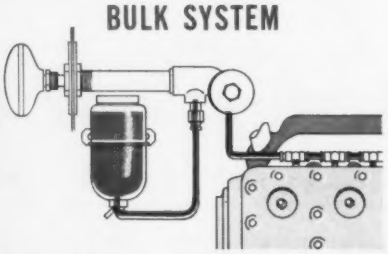
STANDARD OIL COMPANY OF CALIFORNIA,
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY,
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

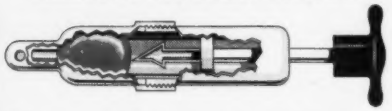
How to apply Chevron Starting Fluid

BULK SYSTEM



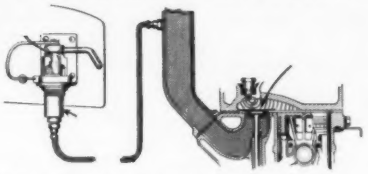
- Pour Chevron Starting Fluid from pint can into bulk applicator mounted near driver...then pump any desired quantity into air intake.
- Fluid gives fast starts in diesel and gasoline engines.

GELATIN CAPSULE SYSTEM



- 7 cc and 17 cc capsules of Chevron Starting Fluid are placed in a vertically mounted panel applicator...fluid is pumped into intake manifold.
- Volatile Chevron Starting Fluid atomizes at temperatures as low as -65°F. Pressure or weakest spark from engine fires mixture.

PRESSURE PRIMER SYSTEM



- Simple discharger mounted on instrument panel punctures small, fireproof, pressurized steel cartridges containing 9.9 cc starting fluid.
- Fluid injected under pressure sprays into combustion chamber, results in immediate starts. Contains additives to inhibit cylinder wear.

For More Information or the name of your nearest distributor, write or call any of the companies listed.

E&MJ NEW PRODUCT DIGEST

In this issue—a bin control, a new diesel engine, a phosphate cleaner on a barge, an interesting drill, a new series D8 Caterpillar, and 55 other new product and literature notices.

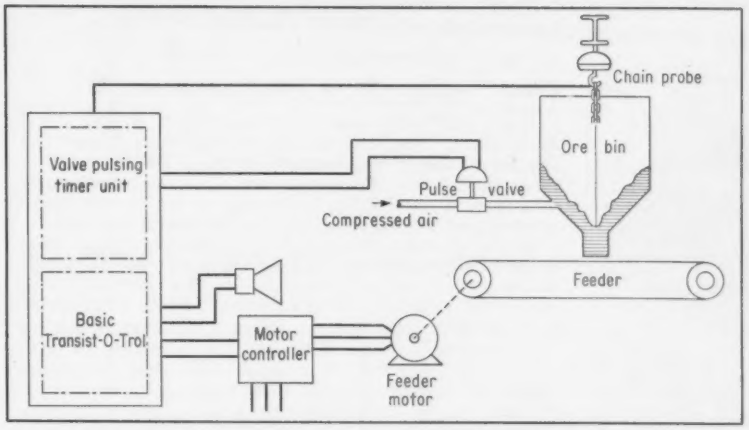


FIG. 1. Typical feeder control system using the Transist-O-Trol Bin Probe.

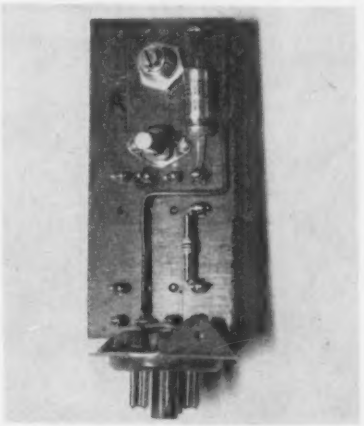


FIG. 2. Plug-in component cans.

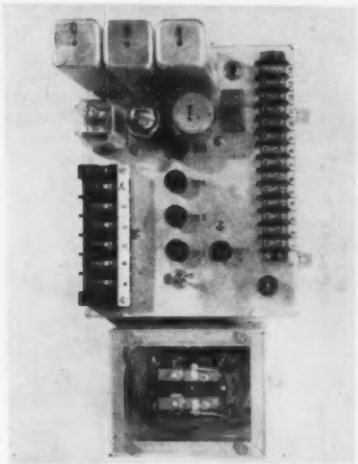


FIG. 3. Plug-in components installed.

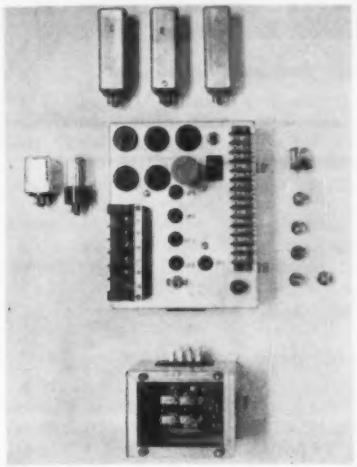


FIG. 4. Basic chassis with plug-ins.

Transist-O-Trol Probes Bins for Blocks and Plugs (1)

Industrial Physics & Electronic Co.'s Transist-O-Trol is a sensitive transistorized probe switch, which may be applied where position of a product can be sensed by a probe.

The Transist-O-Trol can be employed on the feed box of rod mills to prevent their becoming choked with extraneous wood and other materials that cause chutes to plug; prevent ore in bins from channeling and drawing them dry while still containing a substantial amount of ore; at junctions of belt conveyors to detect plugged chutes; for control of pumps, valves, and others. Several applications of this kind are now being installed at a large western concentrator.

The basic chassis of the Transist-O-Trol is shown in Fig. 3. As seen, it contains the following plug-in control units: Component "A" holds the amplifier unit with the small plug-in transistor; component "B" is a 30-v dc full wave rectifier with filter capacitors to produce a filter power supply for the operation of the transistor amplifier; component "C" is a pulser unit used to operate a howler when this is desired; howler actuating relay (at left of chassis); delay timer; miniature pilot relay; selector plugs to change the operating functions of the controls; and power relay to operate large equipment.

The unit operates from 115v ac and employs only 12v ac on the probe circuit, and maximum probe current is 40 microamperes when short circuited, affording safe operation. It is unaffected by extremes of vibration and wide variations in ambient temperatures, and being transistorized no warm up period is required. For indication systems requiring several points of indication, the Transist-O-Trol is available with as many as four points of indication on a single chassis.

If it is desired to operate the unit to actuate a howler immediately after the probe either inters or is removed from the material it is detecting the position of, then the delay timer is replaced by a shortening strap with the result that all functions operate at the same time. If a howler is employed, an alarm silence switch is provided to mute the howler, but the alarm light will remain on so long as the probe condition remains changed.

Various types of operation can be obtained through the medium of the selector plugs, as indicated in Fig. 4. For instance, selector plug SP-3 is used to select whether the pilot alarm light will be on when the probe is touching the material or whether it is to be on when the probe is not touching the material.

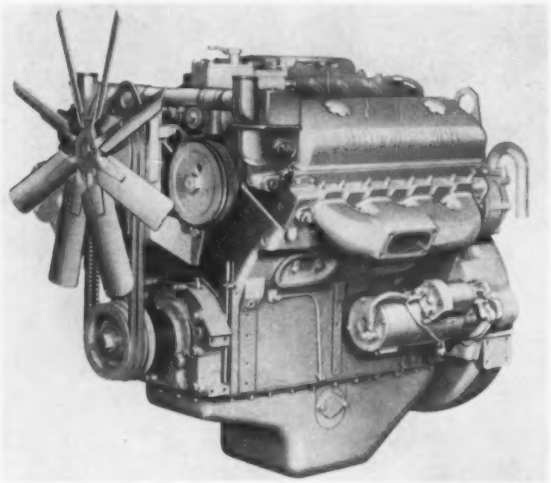
One typical application is shown in Fig. 1 where the device is used to prevent ore from channeling and causing feeders to "run dry" of material. Here, a chain probe is hung on the bin, and the selector plugs are so arranged to cause the following actions to take place:

1. When the chain probe becomes free of muck, a timer unit is energized to cause pulses of compressed air to enter the bin and break down the ore so it will flow freely.

2. To accomplish this the basic timer is plugged into the basic Transist-O-Trol chassis. This timer unit employs two timing elements as follows: One of the timers causes a blast of air of predetermined duration to be subjected to the bin for a period of time determined by timers 1 and 2. If, as a result of the application of these blasts of air, the ore is made to flow freely again, all action ceases and the system is re-

turned to normal. This is accomplished by having caused the ore in the bin to again envelop the chain probe. If, after a predetermined time delay, the action of the blasts of air have not caused the ore to flow freely again, a howler is actuated and after a further time delay the feeder is shut down.

In the event of failure of an "A" component and a replacement unit is obtained from the factory, only minor adjustments are necessary. A dc milliameter is plugged into the jack provided. Prior to turning power on the unit, the protective shield is removed from the "A" can and the potentiometer is turned all the way in clockwise direction. Power is then turned on and the potentiometer adjusted in a counter-clockwise direction until the current read on the milliameter is between 9½ and 10 Ma.



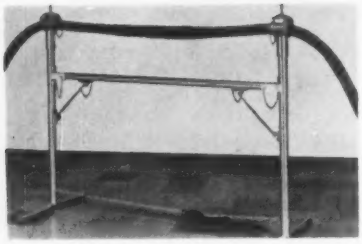
Diesel Engines—20 to 165 Horsepower (2)

Eight new basic units have been added to the 2-cycle diesel engine line produced by Detroit Diesel Engine Div., General Motors Corp. Formerly covering the 30 to 893 hp range, the line now offers single, twin and turbocharged engines with from 20 to 1650 hp, in V-design or in-line construction. The company now offers 13 basic and six multiple designs.

In the 71 Series, four single V's were added with horsepower ratings as follows—252-hp 6V-71, a 334-hp 8V-71, a 504-hp 12V-71 and a 675-hp 16V-71. New multiple V's are the 12V-71 with 1008 hp and the 16V-71 with 1350 hp. The latter, when turbocharged, can deliver a maximum of 1650 hp.

The in-line 53 Series of smaller, lighter engines are available in two, three, and four cylinder construction. Horsepower ratings are from 20 to 130. One V-type is included in the 53 Series—a 6V rated at 195 hp.

Only three cylinder sizes are used in the entire line—pistons, rings, valves, valve lifters, injectors and many other parts may be interchanged, engine for engine, within a given series.

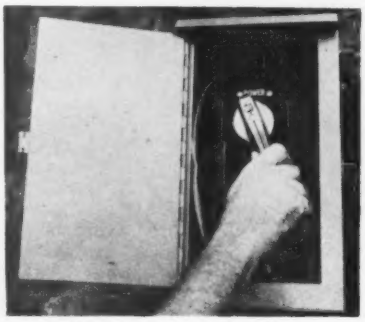


Cable Splicer (29)

Portable electric cable splicer stand that can be quickly assembled and disassembled has been announced by Austin Powder Co. Model H-I can be set up in less than two minutes, weighs only 16 lb, and has hinged pressure clamps. It is suitable for cable up to 3-in. dia.

AN Loader (32)

The Jetloder, developed by Atlas Powder Co., uses compressed air to blow ammonium nitrate blasting agents and sand stemming into blast holes. Jetloder can blow 2½ lb per second of AN-diesel oil mixture into 50- to 60-ft vertical holes. Four 80-lb bags were loaded into one hole in two minutes (as against 3-man crew and 30 minutes with jointed tamping poles). Equipment includes the loader, a 45-psi air compressor and the blowing machine, plus enough 1½-in. plastic loading pipe to reach the back of the hole.

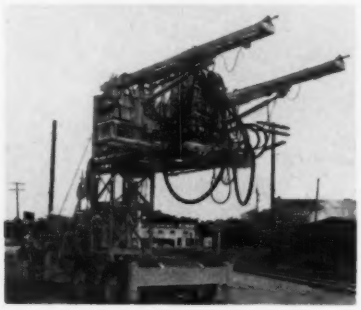


Blasting Switch (35)

Improved timing accuracy of delay electric blasting caps connected in parallel circuits can be achieved with Atlas Powder Co. Arcmaster blasting switch. Load-type circuit breaker limits current duration to 0.025 to 0.030 seconds. Arcmaster is designed for 440 or 220 service.

Small Cryderman (30)

Small Cryderman mucker is designed to work in circular shafts from 6 to 10 ft dia. Smaller shafts can be handled with especially designed bucket. Cage is 24x36 in. with two 4-in. protective skips mounted on the back. Single drum tugger hoist has 2,000-lb rope pull (½-in. cable). Same reliable features incorporated in the larger sizes are found in Betsy, according to Shaft & Development Machines, Inc.

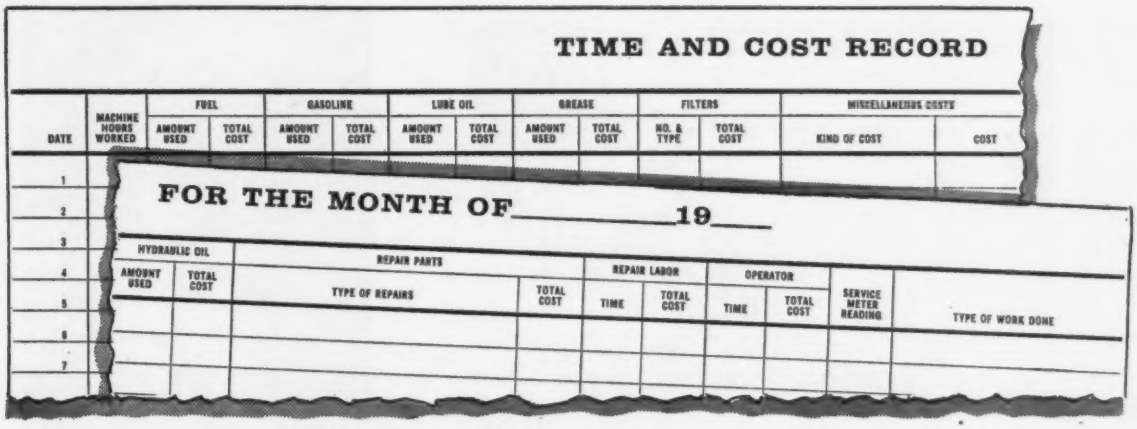


Drill Jumbo (39)

Rogers Iron Works Co. Model VM-212-17 drill jumbo shown here was built for a large salt mine. It can put holes in an area 12 ft wide and 24 ft high on one setting. Other models are available for headings up to 36 ft. Machine is diesel powered with permissible exhaust scrubber. All drilling operations are centralized on one control panel so that one man can operate both machines.

Large Side Dumps (40)

Southern Peru Copper Corp. has ordered eighty-five Baldwin-Lima-Hamilton 43-cubic-yd side dump railroad gondolas for Toquepala. Cars will hold 90 tons of ore, and measure 11 ft wide by 43 ft long.



TIME AND COST RECORD

FOR THE MONTH OF_____19____

DATE	MACHINE HOURS WORKED	FUEL		GASOLINE		LUBE OIL		GREASE		FILTERS		MISCELLANEOUS COSTS	
		AMOUNT USED	TOTAL COST	AMOUNT USED	TOTAL COST	AMOUNT USED	TOTAL COST	AMOUNT USED	TOTAL COST	NO. & TYPE	TOTAL COST	KIND OF COST	COST
1													
2													
3													
4													
5													
6													
7													

HYDRAULIC OIL		REPAIR PARTS		REPAIR LABOR		OPERATOR			
AMOUNT USED	TOTAL COST	TYPE OF REPAIRS	TOTAL COST	TIME	TOTAL COST	TIME	TOTAL COST	SERVICE METER READING	TYPE OF WORK DONE

Time and Cost Record Book Helps Determine Operating and Owning Cost (17)

Time and Cost record book prepared by Caterpillar Tractor Co. contains 24-pages in paired sheets as shown above, listing all the items that contribute to the cost of owning and operating earth-moving equipment. Spaces are provided for both the quantity and cost of oils, lubricants, labor and time, etc. At the end of the month, columns can be totaled to determine expenses. To help compute costs, a section at the back of the book explains simple methods of calculation. A pocket size field book accompanies the office book, and is designed to enable the operator to keep track of expenses, time and data as they occur in the field. Copies are available on request.

Conveyor Belt Splice Eliminates Field Vulcanizing (8)

New splice, registered as Wedlock Splice by Raybestos-Manhattan, is said to be a high-tension mechanical fastener splice consisting of a V-shaped joint which forms a seal under tension. Specially designed tip and tail fasteners anchor the cut. Splice can be made on natural rubber, synthetics, or cord construction.

Plastic Trolley Guard (12)

Vinyl plastic trolley guards are available from American Brattice Cloth Corp. that resist flash fires caused by trolley arcing, withstands 20,000 volts and are flame resistant, mildew and water proof. Available in 12- and 18-in. widths.

Low Seam Shovel Loader (15)

A 28-in. high shovel loader has been developed by Myers-Whaley Co. with 16 ft overall length and 54-in. width. Crawler mounted and hydraulically operated, the machine pumps are driven by either ac or dc motor.

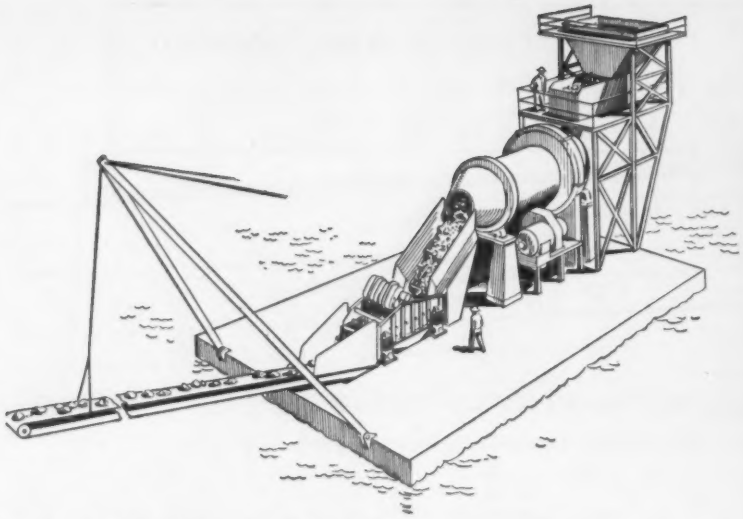
Correction—Merton Loader

In August NPD, we noted the High Discharge Merton Overloader and then turned around and used a photo of the Merton DB.30 Tracked Overloader which has a fixed discharge of 8 ft 8 in. The High Discharge Overloaders come in two models H. D. and E. H. D., and both are wheeled. Super R.H.D. (above) discharges at 26 ft.

Caterpillar Beefs up the D8 to Series H (22)

Caterpillar redesigned the DH Series F machine into a heavier, harder working, stronger, higher horsepower unit and called it Series H. It's bigger than a DH, cheaper than a D9. In comparative tests, a direct-drive Series F D8 was pitted against a direct-drive Series H machine. In a dozing and drifting problem over a 195-ft distance, the new Series H machine moved 200 bank yards per hour while the older machine did only 169. In a second test, the new machine moved 254 bank yards per hour over a 130-ft distance while the older machine handled 205.

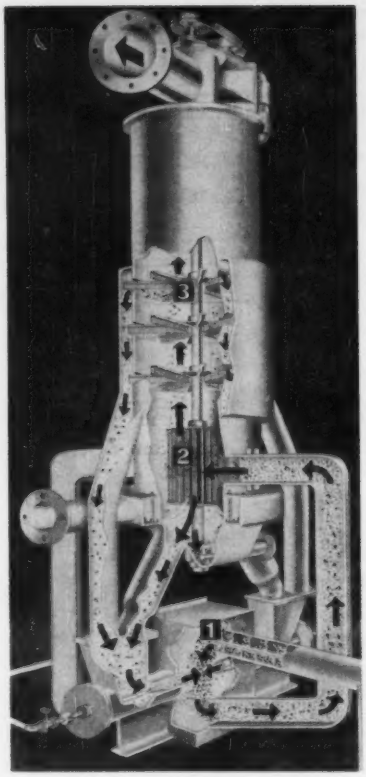
In a straight dozing operation, the Series H outproduced the older machine by 274 to 231 yards per hour. The average blade load of the Series H machine was 5.5 yd as against 5. Features of the Series H are choice of direct drive or torque converter, flywheel horsepower of 225 (drawbar of 180 hp), 5,505 sq in. of track on the ground, 135 gal fuel tank, and double reduction final drive that allows 20-in. ground clearance, life-time lubricated track rollers, common high-pressure lubrication system that does all the oiling and uses only one kind of oil, and a combination dry cyclone and fabric arrester air filter.



Large Scrubber Will Be Mounted on Barge (3)

Large rotary ore scrubber, 35 ft by 11½ ft dia., has been purchased from Allis-Chalmers Mfg. Co. by Conrad Stork-Haarlem, partner of I. H. C. Holland, Netherlands, for installation at Senephos Co., Senegal, French West Africa. Scrubber will constitute a major part of a floating 400 tph phosphate plant, and will deslime minus 20-in. feed. Scrubber will be driven by a 550 hp motor through a pinion and girth gear. At Senephos, the cleaning plant will be fed by a 7½-yd dragline mounted on a separate barge.

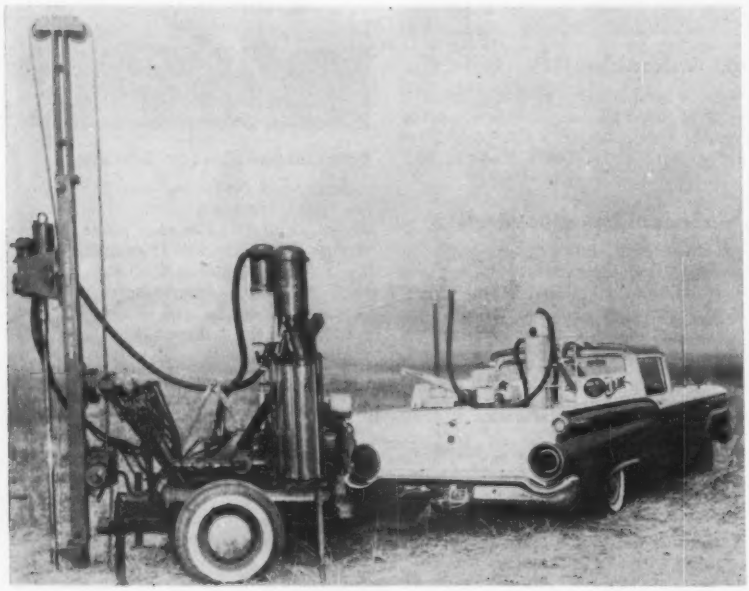
Also from Canadian Allis-Chalmers comes a note that an 84x60-in. Superior jaw crusher was recently shipped to an Indian firm near Calcutta. At an 8-in. setting, the crusher will break 700 tph of iron ore. Unit will be installed along with two 24x60-in. Superior gyratory crushers equipped with the Hydroset mechanism. All three crushers will be fitted with bearing temperature alarms.



Opposed Jet Pulverizer (4)

Majac, Inc. takes exception to Theodore Nagel's recent article in *E&MJ* on impact shattering of solids through opposed jets. Seems that Majac has been marketing such a device for many years.

Pulverizing zone (1) on the Majac consists of a feed inlet blowing feed through two opposed jets, using steam, gas or compressed air. A stripping zone (2) is used to flash dry wet material and to return oversize into the jets. A classifying zone (3) sends undersize to the dust collectors and oversize back to the jets. Machines are available with capacities ranging from 1000 to 30,000 lb/hour capacity depending on fineness desired, using from ½ to 35 hp, based on grinding coal to 90% minus 200 mesh.



Drill Removes Cuttings Six Different Ways (7)

Houston Tool Co. says that their new Injector drill Model H. D. 250 will remove cuttings from the hole in six different ways—vacuum, reverse water, forced water, vacuum diamond core, drive coring and augering. Drill will drive at any angle in any formation. It will drill a 2⅜-in. hole to 150 ft; a 3⅛-in. hole to 100 ft; forced water holes to 250 ft; and continuous flight auger to 100. Unit weighs 1,800 lb and can be mounted on any four-wheeled truck or trailer.

Mine Car Holder (10)

Automatic mine car trip holder that eliminates the need for manual handling of skids on down grades has been named the Hold-A-Trip by Nolan Co. It can be used in conjunction with the Nolan Port-A-Feeder.

For more information on products and literature circle the proper number on the card and mail to E&MJ.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Exploration and Mining

HOW TO RETHREAD Sandvik Coromant extension rods is the subject of an illustrated four-page bulletin prepared by Atlas Copco. (E-434). **(51)**

SOIL ENGINEERING, its purpose and scope, is the subject of a 16-page bulletin prepared by Mobile Drilling, Inc. Entitled "Men Build Highways —Drills Make It Profitable", the report tells how much valuable soil information is being collected by roadbuilders. **(52)**

SPECIAL equipment for Allis-Chalmers crawler tractors and motor graders is featured in a 12-page catalog (MS-1189). **(53)**

ADJUSTABLE speed drive from Louis Allis Co. is detailed in a bulletin (2750) now available. Redesigned construction eliminates brushes, commutators, sliprings and reduces overall length. **(54)**

DRIP-PROOF pancake motor bulletin published by Louis Allis Co. says that new design has reduced motor length by up to 54% over standard shapes. 4pp. (2150) **(55)**

HOW FLOMAX pumps are designed and a case history from a coal stripping operation are included in a four-page bulletin (1002) prepared by Marine Products Co. **(56)**

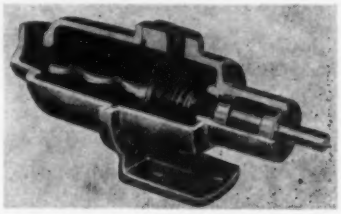
GAS REGULATORS and cylinder manifold station catalog (806) contains flow and pressure specifications, dimensions, adapters, flowmeters and pressure gage data in 36 pages. Air Reduction Co., Inc. **(57)**

AIDS FOR PREVENTING excessive bearing wear and column failures in hydraulic cylinders have been set down in Miller Fluid Power Div., Flick-Reedy Corp. literature. **(58)**

BRUSHLESS ALTERNATORS in the Kato Engineering Co. line are illustrated in a 16-page bulletin. **(59)**

UNIT-TYPE AIR COMPRESSORS are available in pressure ratings from 80 to 250 psi according to Le Roi Div., Westinghouse Air Brake Co. 12-page bulletin (SG-2). Types described include—G single stage, YS single stage, and YC two stage. **(60)**

PLAN to stay ahead . . . modernize . . . is the theme of Allis-Chalmers 59 ideas for Modernization in '59. Case histories in the Allis-Chalmers line. 20pp. (25B9084). **(61)**



UTILITY PUMPS have no vanes, turbines or impellers. In fact, the only moving part is a rubber stator according to Continental Pump Co. 8-page bulletin-catalog. Illustrated in cutaway above. **(63)**

CONTROLLERS for temperature, pressure, or both, in the Taylor Instrument Companies Fulscope line are presented in a 24-page bulletin (98291). Price list is also available. **(64)**

INTEGRAL-SHAFT SHEAVES in the Vari-Pitch design by Allis-Chalmers for stepless speed control of large machine drives are presented in a 6-page bulletin (20B7897B). **(65)**

HIGH-INTENSITY magnetic separator of the induced roll type is described in Stearns Magnetic Products latest four-page bulletin. Table lists over 100 minerals, source and calculated attractability. **(66)**

CLARIFIERS and Oxidators for handling sewage, water and industrial waste are detailed in Process Engineers, Inc. literature (SM-1005). **(67)**

90-DEG BELT TURN UNIT modified from that designed by a major coal producer and manufactured by Joy Mfg. Co. permit continuous miners to drive cross-cuts between rooms on wide centers and often saves relocation of conveyors, according to 4-page bulletin (LD-109) prepared by Joy. **(68)**

Metal & Mineral Processing

MANUAL on parts replacement for Allis-Chalmers crushers will help users keep downtime at a minimum. It lists parts by catalog number, quantity, description and part number for every part in a crusher. It shows an outline of the machine with catalog numbers at proper location. Also lists those parts that are interchangeable. **(69)**

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. FEB. 1959

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

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9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
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16	32	48	64	80	96	112

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Address .....

E&MJ NEW PRODUCTS DIGEST (*Continued*)

GEARLESS GYRATORY reduction crushers in 10 sizes are presented in Kennedy Van Saun bulletin (58-D). Sizes vary from 9½ to 85½ in. and in capacity from one to 950 tph. **(71)**

PROCESS THICKENERS — hydroseparators, reactor-thickeners, air-lift agitators and slurry mixers—are presented in Eimco Corp., Process Engineers, Inc. Div. bulletin (SM-1004). 6pp. **(72)**

BELT CONVEYOR bulletin published by Western Engineering Machinery Co. tells how to estimate WM conveyor requirements, shows capacities, recommends belt speeds. **(73)**

HORIZONTAL-GRATE COOLERS offer heat recovery, low fuel cost, higher production and complete material cooling according to Fuller Co. bulletin (CO-6). 4pp. **(74)**

CONVEYORS, designed for high temperature use by Carrier Conveyor Corp., are illustrated in a four-page data sheet (700-HT-9). Three new designs are shown. **(75)**

PIPELINE AFTERCOOLERS for air compressors with steel shell construction, corrosion-resistant tube bundle, countercurrent flow and centrifugal moisture separator are illustrated in Ross Heat Exchanger Div., American-Standard literature (302.6K). 8pp. **(76)**

TRAY-TYPE deaerating heaters to safeguard boilers are presented in Graver Water Conditioning Co. bulletin (WC-106A). 12pp. **(77)**

ROTARY VACUUM DRYERS with double-spiral agitators which insure maximum drying action by constantly mixing and braiding the material, spring-loaded scrapers, zoned heating and cooling are illustrated in F. J. Stokes Corp. bulletin (610). 4pp. **(78)**

THE MEASURE OF TUBEMANSHIP is the title of a brochure prepared by Wolverine Tube Div., Calumet & Hecla, Inc., which stresses the skills and techniques employed by Wolverine to manufacture seamless copper and copper alloy tubing. **(79)**

RIGID KOROSEAL polyvinyl chloride pipe, fittings and valves for both normal and high-impact use, are presented in a catalog (10050-A) published by B. F. Goodrich Industrial Products Co. Specifications, physical properties and chemicals handled are included. 4pp. **(80)**

RUBBER-METAL products manufactured by Clevite Harris Products, Inc. are set down in a 12-page catalog. Bearings, bushings, couplings, mounts, sleeves and molded shapes are included. **(81)**

HEAT RESISTANT PAINTS technical data file has been prepared by Joseph Dixon Crucible Co. Included is a 1,000 deg F temperature range reference chart for seven different Dixon heat-resistant coatings. (V-89). 4pp. **(82)**

RIGID PLASTIC PIPE for gas lines, chemical piping, deep wells and electrical conduit use is illustrated in Carlon Products Corp. bulletin (HT-100). 6pp. **(83)**

SHOCK DAMPENING and vibration-isolating Sorbtex, a newly-developed, pre-formed pad material, for heaving machinery is discussed in Voss Belting & Specialty Co. literature. 4pp. **(84)**

1959 REFERENCE GUIDE to Dow Corning silicone products describes what silicones can do, where and how they are being used. 16pp. **(85)**

ENGINEERING PROPERTIES of Ni-Resist Ductile Irons is the title of a 28-page booklet published in its second edition by International Nickel Co., Inc. Cast ductile iron is recommended for its heat, wear and corrosion resistance. **(86)**

INVESTMENT-CAST wear-resistant alloys—a group of cobalt-base and iron-base alloys for extreme conditions of wear, abrasion and heat—in the Haynes Stellite Co. trade name are discussed in an 8-page bulletin (F-30,132). **(87)**

HASTELLOY alloy F, with good resistance to both oxidizing and reducing corrosives, pitting and stress-corrosion cracking, is discussed in Haynes Stellite Co. bulletin. 12pp. (F-30,128). **(88)**

THE ROLE of Molybdenum in steel castings for industrial equipment is the title of a thoroughly illustrated 36-page paper prepared by John Wallace, Case Institute of Technology for Climax Molybdenum Co., Div. American-Metal Climax, Inc. **(89)**

PNEUMATIC TEMPERATURE control line developed by Partlow Corp. is introduced in a four-page bulletin. Units operate in ten optional temperature ranges from minus 30 to 1,100 deg F. **(90)**

INDICATING DIAL thermometers developed by U.S. Gauge Div., American Machine & Metals, Inc. for temperatures in the range of minus 40 to 1,000 deg F are illustrated in a 12-page catalog (205). **(91)**

VORTEX-TYPE burners bulletin (116) published by Thermal Research & Engineering Corp. offers detailed descriptions of six standard models with outputs up to 50-million Btu/hour. 4pp. **(92)**

FUEL BURNING systems, particularly the Model 3 Orr & Sembower, Inc. unit, are illustrated in an 8-page bulletin (1255). Fuel consumption ranges from 20 to 300 gph on oil and from 3,000 to 40,000 cfh on 10,000 Btu-gas. **(93)**

ENSIGN-BICKFORD
LOW-TEMP PRIMACORD
IS *flexible*
EVEN AT 40° BELOW!

Keep your mittens on! You can still make those tight, double-half-hitch connections with your Primacord down-lines, when your trunk line is Ensign-Bickford Low-Temp Plastic Primacord.

Low-Temp Primacord remains flexible at low temperatures. It forms knots and half hitches that can be drawn up tight without slipping. Its resistance to oil and water penetration is superior to the textile-clothed Primacords. It is light in weight, tough and strong — easy to handle even when you have your mittens on!

Now add the well-known Primacord advantages: 1) Less hazard because Primacord is the insensitive detonating fuse which cannot be set off by friction, ordinary shock, sparks or stray electrical currents. It must be detonated with fuse and cap or electric blasting cap, attached to the trunk line *only* after all is ready for the blast. 2) While the detonation wave of Primacord travels at nearly four miles a second, it provides the infinitesimal interval between holes and rows of holes sufficient to effect relief of burden, with better fragmentation, easier digging, less secondary blasting.

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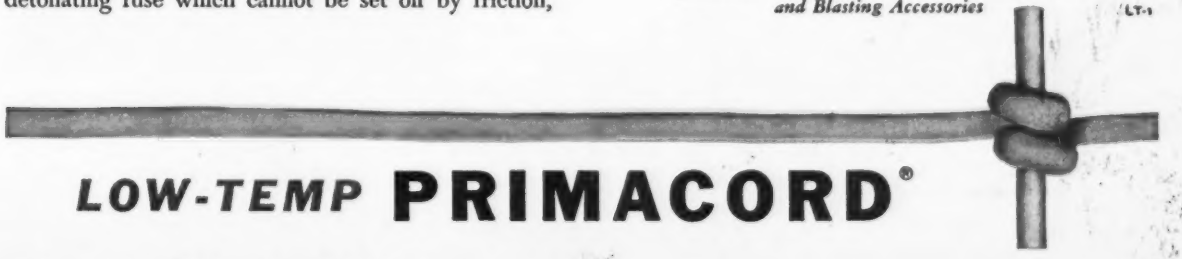

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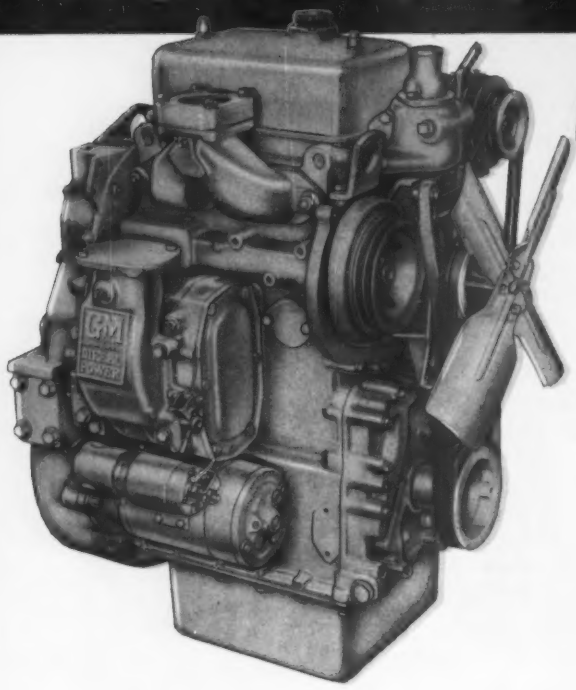


Now a *DIESEL* Engine for JOHN DEERE 440 TRACTORS

Bringing you every DIESEL advantage PLUS 10% MORE POWER

Here, power-matched to John Deere "440" Crawlers and Wheel Tractors, is a modern Diesel power plant that means even greater savings for you on time and fuel. Equipped with this famous "Jimmy" Diesel engine, John Deere "440" Tractors not only provide *more* power—10 per cent more than previous tractors in the line—they also give you the *faster* response of high-compression, high-torque Diesel performance.

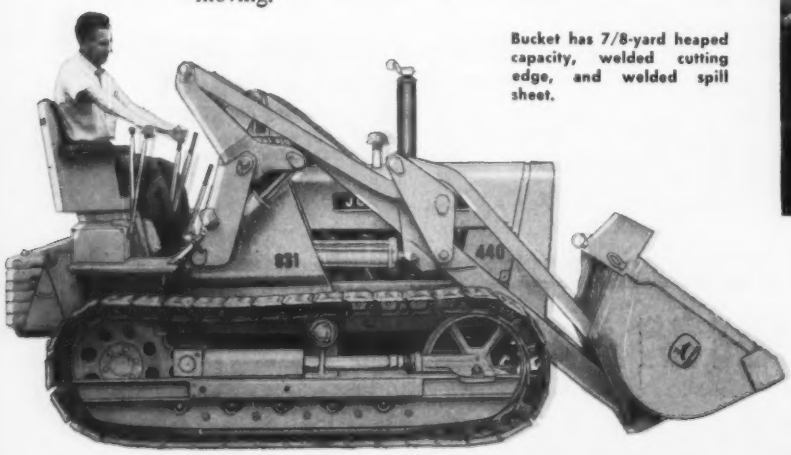
In addition, the "fire insurance" of Diesel fuel opens up new construction and materials-handling jobs to the John Deere "440" in mines, dockyards, and other confined areas.

Whatever your reasons for preferring Diesel power, act now—cash in on modern Diesel advantages with a John Deere "440" Crawler or Wheel Tractor and matched working equipment.

A *New* answer to speedy, low-cost loading... THE JOHN DEERE 831 LOADER

Take your choice of John Deere gasoline or Diesel power, but pick the new John Deere 831 Loader for a *new low* in earth-moving costs! Rugged construction, plus the husky hydraulic system of the "440," provides extra pry-out pressure and lifting ability that greatly increase daily work capacity.

Check into the new John Deere 831 Crawler-Loader now—start setting new records for low-cost earth moving.



Bucket has 7/8-yard heaped capacity, welded cutting edge, and welded spill sheet.

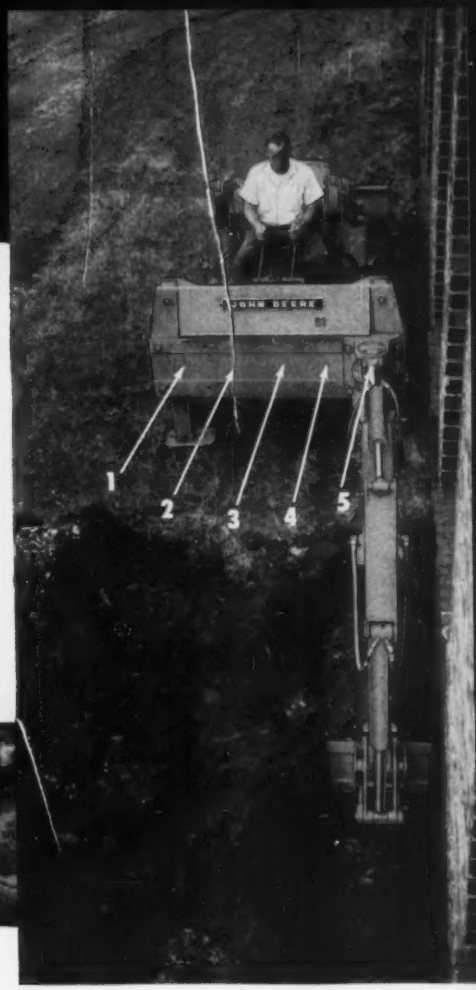
When bucket is dumped from full-height position, it returns to the ideal 9-degree digging angle by use of the boom control only.

JOHN DEERE

Introducing the FIRST 5-POSITION BACKHOE in the Field... THE *New* JOHN DEERE No. 51

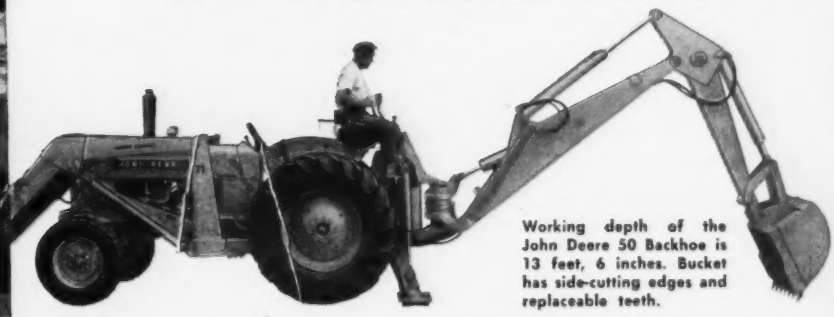
One man with a wrench can set the boom on this John Deere 51 Backhoe in any of five mounting positions—in 15 minutes or less. End position at right or left speeds flush-digging along buildings. End mounted, the hoe folds against tractor to make a compact, well-balanced unit for transporting.

Ground-level reach: 20 feet, 9 inches. Working depth: 13 feet, 6 inches. Dumping height: 11 feet. Boom travel: 180 degrees.



PLUS

...a brand *New* center-position BACKHOE... THE JOHN DEERE No. 50



Working depth of the John Deere 50 Backhoe is 13 feet, 6 inches. Bucket has side-cutting edges and replaceable teeth.

Here's reach and power to tackle any trenching job! Center-mounted boom has a 20-foot, 3-inch reach at ground level, swings smoothly through a 205-degree arc by hydraulic power. Two control levers do the job, while operator sits in comfort. Same hydraulic system that operates backhoe also powers loader.

JOHN DEERE
Industrial
Tractors and Equipment

Completely Engineered for Industry

SEND FOR FREE LITERATURE
JOHN DEERE INDUSTRIAL DIVISION
• Moline, Ill. • Dept. D-70

Please send free information on ☐ "440" Diesel Crawlers ☐ "440" Diesel Wheel Tractors ☐ 831 Loader ☐ 50 Backhoe ☐ 51 Backhoe.

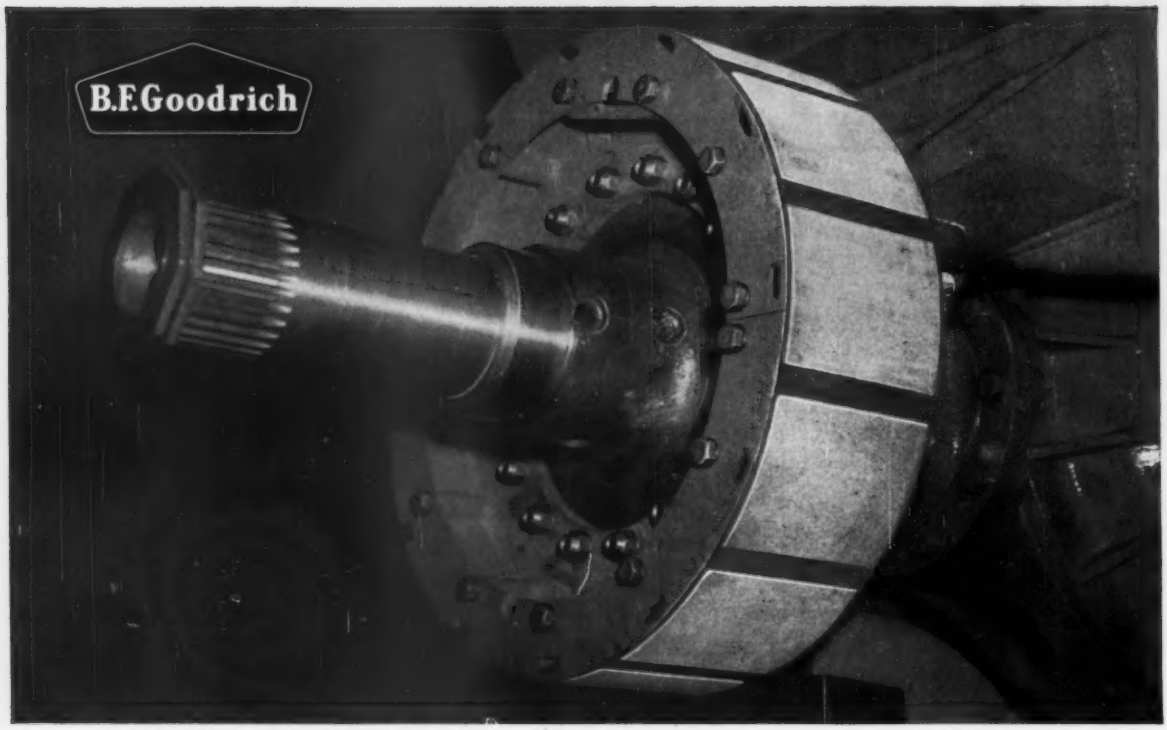
Name _____

Firm _____

Address _____

City _____

State _____



The *only* off-road brake with *full circle stopping power*

Tests prove the B.F.Goodrich Hi-Torque Brake can stop your heavy equipment faster, safer!

Tractor-Scraper Test

	B. F. Goodrich Hi-Torque	Conventional two-shoe brake
Stopping distance	41′ 9″	72′
Speed	14.83 mph	15.17 mph
Load	heaped	heaped

Two identical tractors and scrapers were used for this test. Unit fitted with B. F. Goodrich Brakes stopped almost twice as fast as unit using regular production brakes.

Off-Highway Truck Test

	B. F. Goodrich Hi-Torque	Conventional two-shoe brake
Deceleration rate	18 Ft/sec^2	7 Ft/sec^2
Speed	25 mph	25 mph
Gross vehicle weight	112,000 lbs.	112,000 lbs.
Wheel condition	sliding	rotating

Popular 24-ton capacity off-highway truck with original production brakes was run over test course. Immediately after fitting the same vehicle with B. F. Goodrich Brakes, the truck made the same run again, stopping almost *two and a half times* as fast.

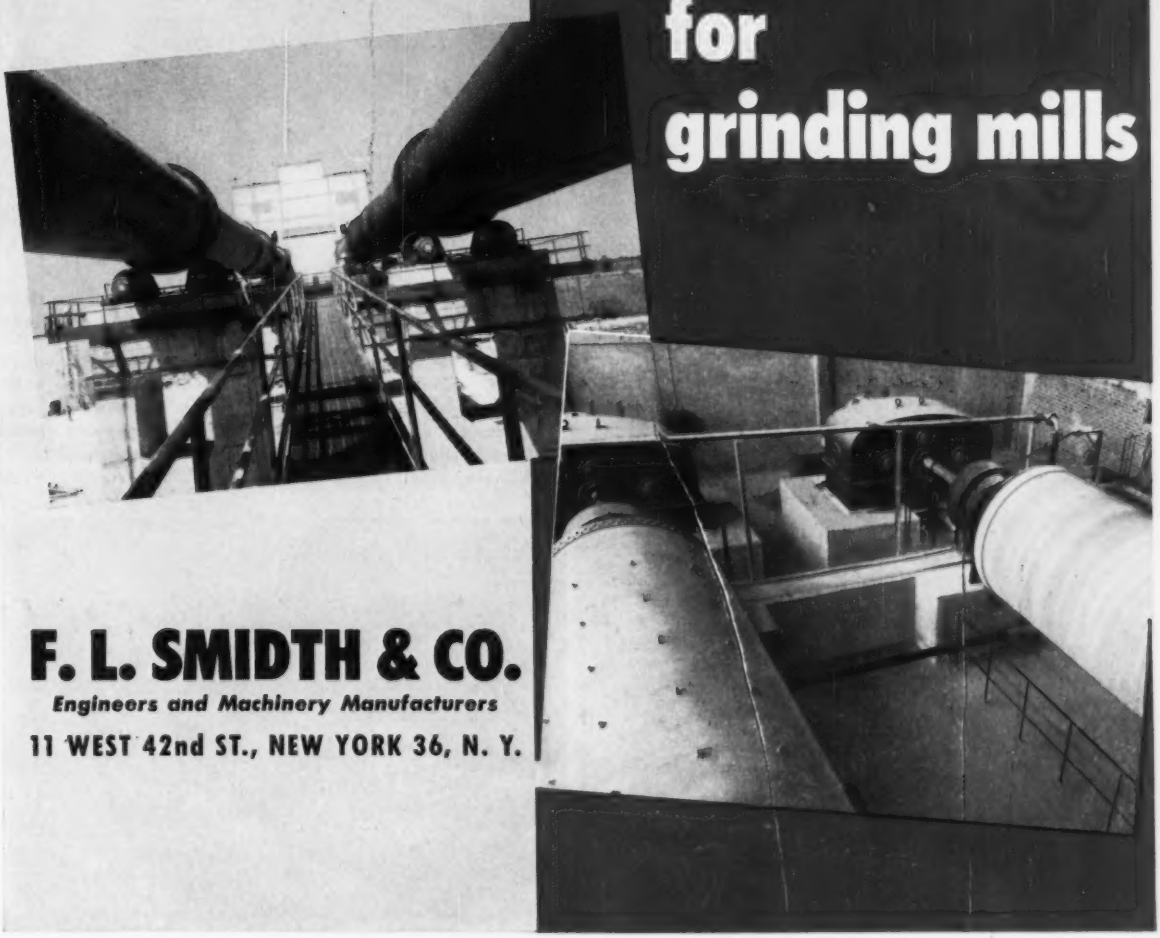
For more information on how the B. F. Goodrich Hi-Torque Brake can help your equipment operate more safely, more dependably, write *B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Dept. EM-29, Troy, Ohio.*

B.F.Goodrich Hi-Torque brakes

SMIDTH

rotary kilns...
grinding
mills and

symetro drives
for
grinding mills



F. L. SMIDTH & CO.

Engineers and Machinery Manufacturers

11 WEST 42nd ST., NEW YORK 36, N. Y.

These are the profit-proven that lead to Payhauler® fleet

Look into the rock-lugging, grade-beating 24-ton "95"...

- **Bonus-powered**, with a 335 hp high-torque turbo charged diesel engine to beat steep grades and high altitudes with full payloads!
- **Your choice of torque converter** with power-shift, or 9-speed constant mesh transmission. Speeds to match every load and road.
- **Shock-cushioning** of planetary drive axles.
- **Massive frame stamina**—with 277 lbs. of high-strength, shock-resisting steel for each rated ton of carrying capacity.
- **Springs with extra leaves** and **extra length** to cushion the payload, smooth the ride.
- **Positive power-steering, Torqmatic braking**, panoramic vision, for unmatched operating ease and load-speeding safety.
- **Up to 25% higher hauling speeds**—the "95" can high-ball, fully loaded, up to 38 mph.
- **Faster reverse speeds**—for spotting to load, or positioning full loads for dumping. The gear-drive "95" can travel up to 7.1 mph. in reverse.
- **9-second dumping**—another cycle-speeding feature.

...and the 250-hp, 18-ton "65" has equally outstanding features.

International® Construction Equipment

International Harvester Co.
180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Power for steep grade climb-outs wins steady job for five "65's"

Bonus Turbo Charged Diesel power to deliver extra-tonnage loads up a haul road with a 17% average grade accounts for the dependence of Caldwell Engineers on five "65" Payhaulers—on the $13 million hydro and flood-control Oliver Dam, Columbus, Ga.

Contractor doubles load delivery speed with positive Torqmatic braking!

Central Pennsylvania Quarry and Stripping Co. credits *Torqmatic braking* of their 5-unit "95" Payhauler fleet with doubling load delivery speed—by increasing safe downhill hauling speeds! They've compared "95's" directly to other off-road equipment on rock-hauling duty!

features ownership!

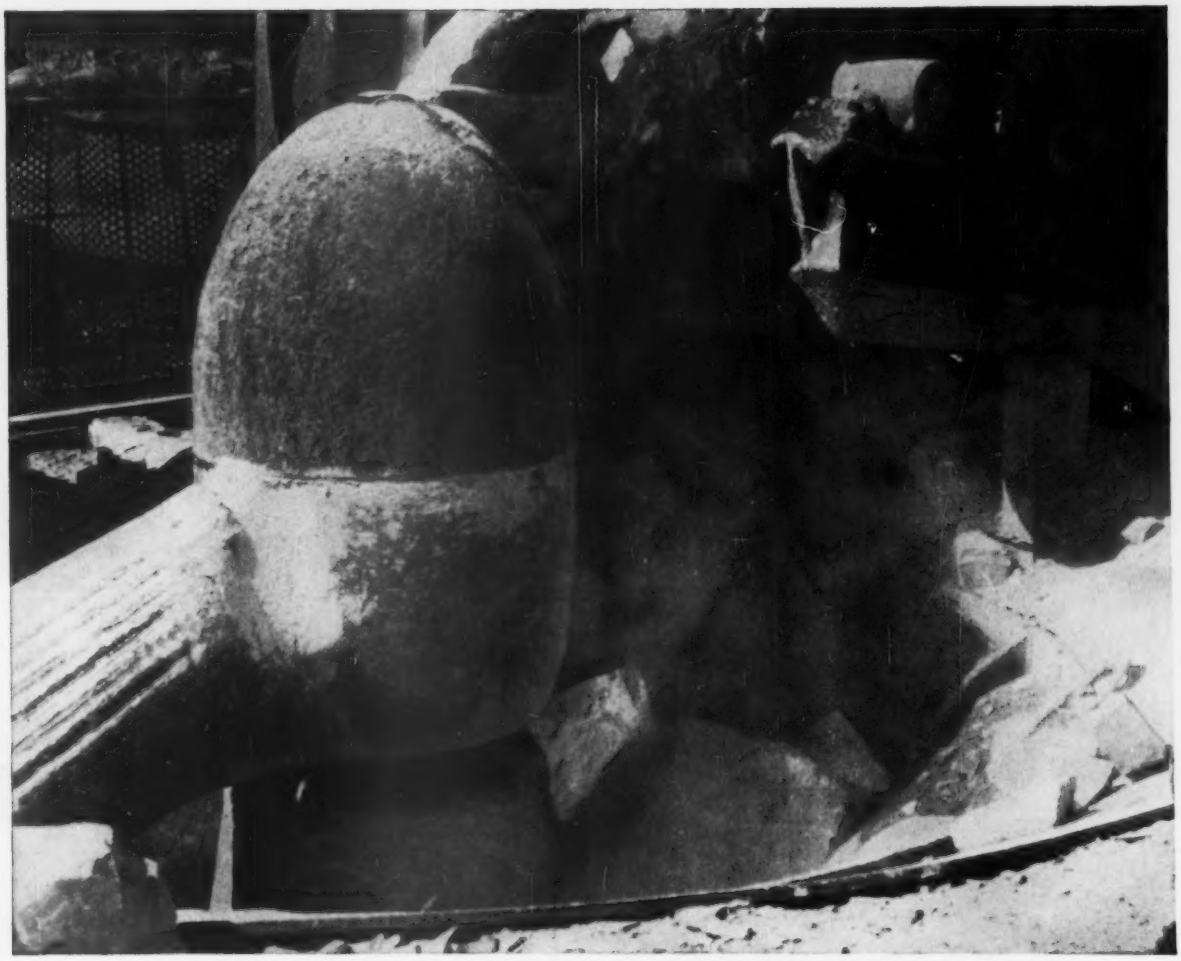
Prove what it means to command the Payhauler ratio of power to payload—for hauling up to 25% faster; beating grades and altitude. Try Payhauler "pick-up-truck" spotting ease—"zip-around" power steering—exclusive high reverse—and all the other Payhauler advantages. See your International Construction Equipment Distributor for a demonstration!

High-percentage availability proves inbuilt stand-up-ability!

98.5 work availability through one measured 12-week period is the mark set by a 10-unit "95" Payhauler fleet—high-balling rock over steep High Sierra grades, on mammoth Pool Hydro Project, for Southern California Edison Co. Such records result from reserve power, reserve frame and transmission strength, and reserve shock-resistance!

Another thirty "95" Payhaulers join Merritt-Chapman and Scott fleet!

Merritt-Chapman and Scott Corporation has added thirty more "95" Payhaulers to their Niagara Power project equipment spread. Now, the M-C and S Payhauler fleet totals 62 units—largest in the world! On St. Lawrence Seaway, huge Glen Canyon dam, and Niagara Power Project, M-C and S have proved rock-lugging, grade-beating Payhauler performance—and confirmed their satisfaction with repeat orders.



Crushers like this – fitted with Ni-Hard concaves – are turning in impressive service records at Spencer Quarries, S. D. They crush Sioux Quartzite, which, like Taconite, is among the hardest known minerals . . . and it has a compressive strength of over 100,000 psi.

NI-HARD crusher concaves outlast manganese steel 3 to 1

At Spencer Quarries, Spencer, South Dakota, Ni-Hard* concaves in 6-inch crushers, have lasted three times longer than manganese steel rings in the throat area, where compression forces are highest.

In a 30-inch gyratory crusher at Spencer, Ni-Hard bottom ring concaves are in their third year of service – where previously the best manganese steel rings wore out in six months. All of Spencer's Ni-Hard concaves were supplied by Brom Machine and Foundry Co., Winona, Minn.

Whether crushing quartzite at Spencer or working tough Taconite on the Mesabi Range, economical Ni-Hard nickel-chromium cast iron is proving better able to resist abrasion and high compression forces than any other material.

Ni-Hard concaves are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

*Registered trademark

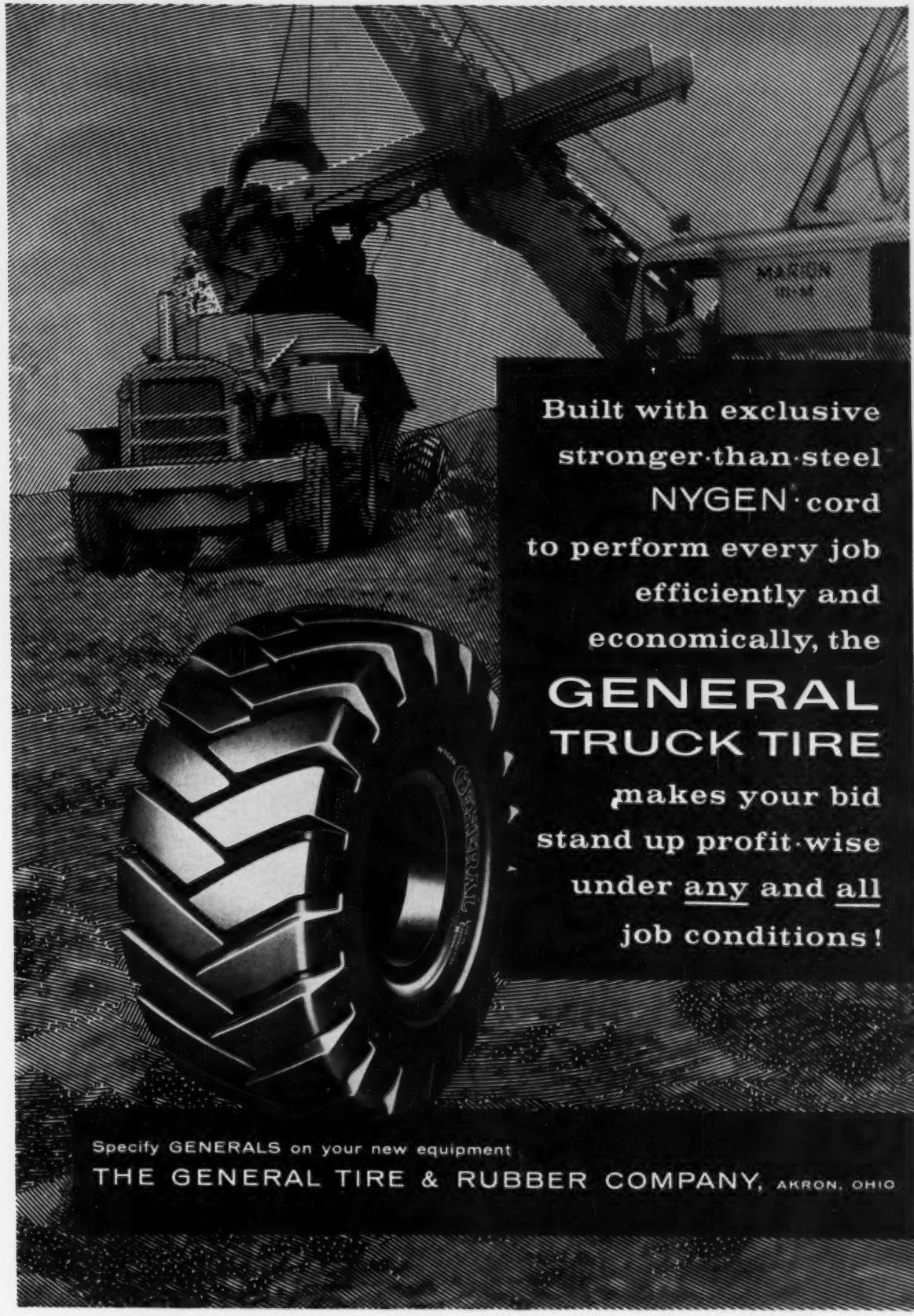
THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall St. INCO New York 5, N. Y.

Looking down the throat of a gyratory crusher. Concaves in the important lower ring are of long-lasting Ni-Hard.

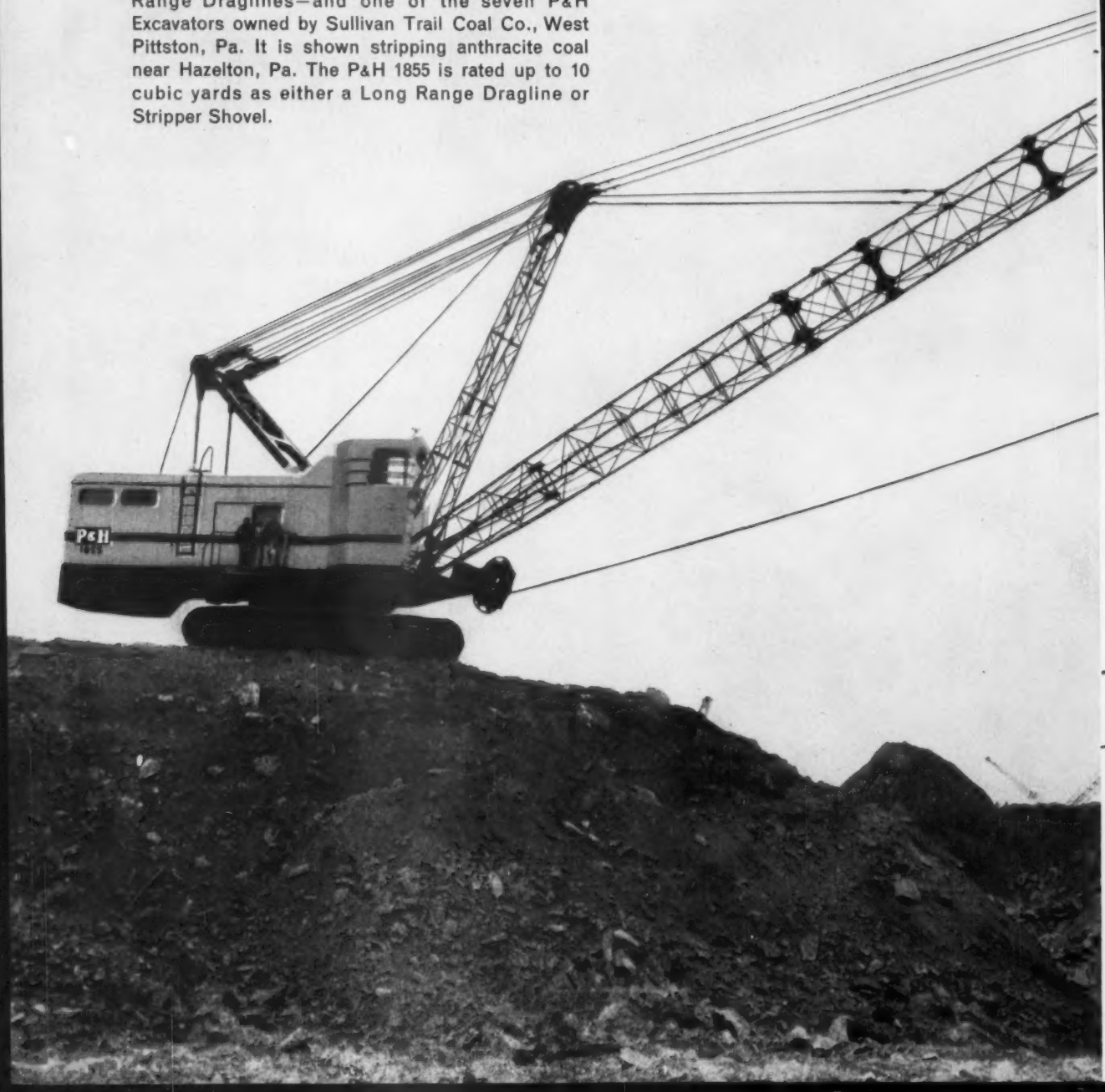
NI-HARD

NICKEL MAKES ALLOYS PERFORM BETTER LONGER


Built with exclusive
stronger-than-steel
NYGEN® cord
to perform every job
efficiently and
economically, the
GENERAL
TRUCK TIRE
makes your bid
stand up profit-wise
under any and all
job conditions!
Specify GENERALS on your new equipment
THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

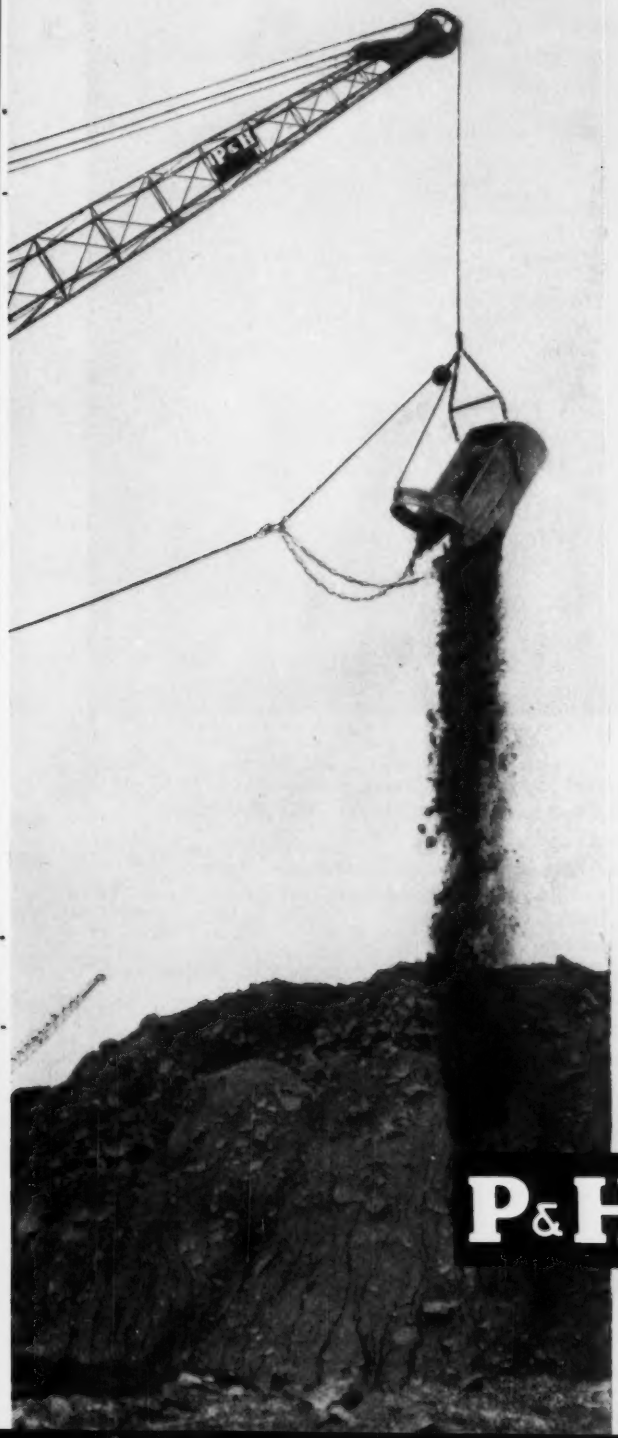
AT SULLIVAN TRAIL

Illustrated is one of two P&H Model 1855 Electric Long Range Draglines—and one of the seven P&H Excavators owned by Sullivan Trail Coal Co., West Pittston, Pa. It is shown stripping anthracite coal near Hazelton, Pa. The P&H 1855 is rated up to 10 cubic yards as either a Long Range Dragline or Stripper Shovel.



COAL COMPANY... *One P&H always sells another because*

P&H "PROFIT·YDS." reduce open-pit stripping costs all day...every day



Faster swings, higher line speeds, greater line pulls and *maximum* availability all add up to lower cost per yard stripped.

Continuous, high production stripping with P&H Electrics in open-pit mining the world over is the end product of these patented principles:

MAGNETORQUE®... this drive electro-magnetically transmits power from a single A.C. motor to all work motions—drag, hoist, swing and propel. Because of Magnetorque the P&H 1855 swings at speeds unmatched for draglines of such long booms and large buckets.

ELECTRONIC CONTROL . . . the most responsive electric excavator control, which provides the fastest work cycles known on electric shovels and draglines.

Also, with P&H you get single source responsibility —an exclusive advantage experienced only by users of P&H Electrics. P&H manufactures their own electrical equipment—*designed specifically for electric shovel service*—as well as mechanical equipment.

These patented P&H design principles offer more net profit to users—up to 10% more production, as much as 60% less electrical maintenance expense and downtime reduced as much as one half from that usual to excavators of this size.

OUR 75TH YEAR

P&H MINING EXCAVATORS

HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

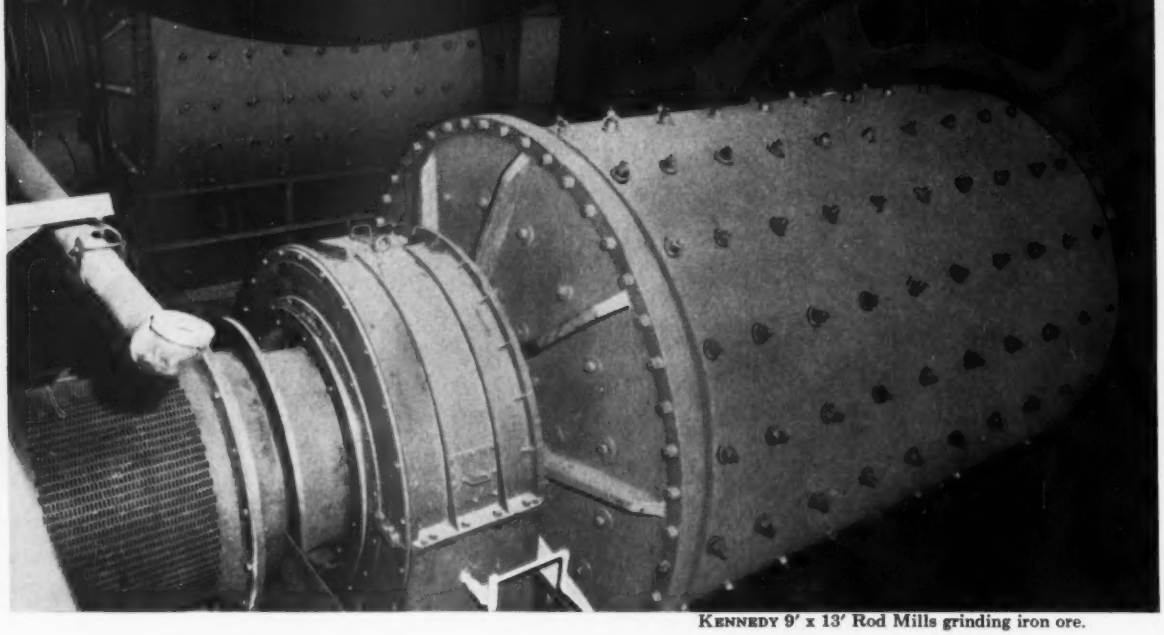
P&H ELECTRIC SHOVEL LINE: 3½ through 10 cu. yd. capacities

KENNEDY ROD MILLS

for the Mining Industry

Dependable operation in wet or dry grinding of material at low cost, with minimum maintenance—this is the reputation that KENNEDY Rod Mills enjoy.

You can profit from this reputation by specifying KENNEDY.



KENNEDY 9′ x 13′ Rod Mills grinding iron ore.

features that distinguish

KENNEDY GRINDING MILLS

- Cast steel or Meehanite heads
- Welded and stress-relieved heavy steel plate shells
- Large diameter trunnions
- Self-aligning bearings with adjustable sole plates
- Positive "Ferris Wheel" lubrication of main bearings
- Oil-tight bearing seals
- Motorized hydraulic lift to reduce starting torque
- Single helical cast steel gear and pinion

Send for complete information on KENNEDY equipment.

Primary & Secondary Gyratory Crushers—Jaw Crushers—Roll Crushers—Ball Mills—Rod Mills—Air Swept Mills—Impact Breakers—Hammer Mills—Belt Conveyors—Feeders—Vibrating Screens—KENNEDY Research and Testing Services.

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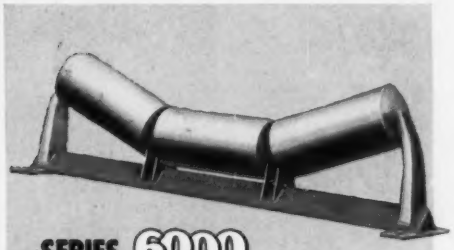
MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N. Y. • FACTORY, DANVILLE, PA.

The LINK-BELT idler line for mining . . . now

EVEN BROADER! EVEN BETTER!

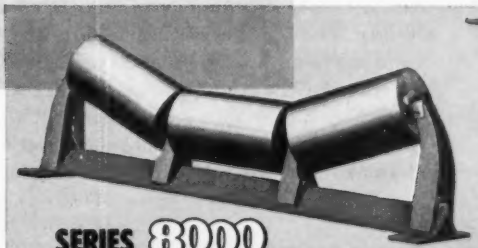


SERIES 6000

For general conveyor service, maximum loads of 100 lbs. per cu. ft.—moderate lump sizes. Designed for conveyors carrying medium loads or for installations requiring intermittent operation. 14- to 36-in. belt widths. Available with greaseable or factory-sealed precision type ball bearings.

SERIES 7000

For continuous operation . . . high capacities . . . heavy-weight, abrasive materials. 18- to 48-in. belt widths. Equipped with precision roller bearings.



SERIES 8000

For continuous operation . . . higher capacities . . . heavier-weight, abrasive materials. 24- to 60-in. belt widths. Equipped with precision roller bearings.

Link-Belt introduces many new types and sizes . . . new features, new numbers

Yes, Link-Belt's newly expanded line permits selection of a belt conveyor idler that matches handling requirements more exactly than ever before. And design improvements have created manufacturing efficiencies that contribute to our ability to offer a quality line without added cost or price premiums.

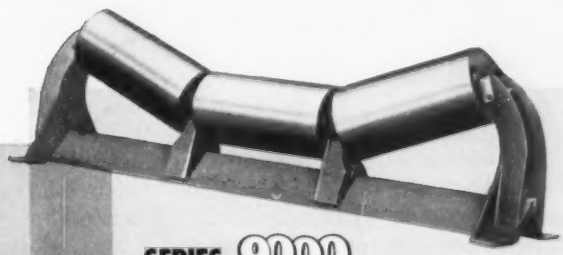
Ranging in application from light-weight materials of less than 100 lbs. per cu. ft. to such heavy ores as copper and iron, Link-Belt idlers are made for a broad range of belt widths, with rolls of various diameters, materials and coatings. This broad coverage avoids wasteful over- and under-engineering . . . permits "pin-pointing" that results in substantial savings in purchasing and maintenance.

For further facts on this new, expanded line—contact your Link-Belt office or stock-carrying distributor. Look under CONVEYORS in the yellow pages of your phone book. Or write for new Catalog 2716.

LINK-BELT

BELT CONVEYOR IDLERS

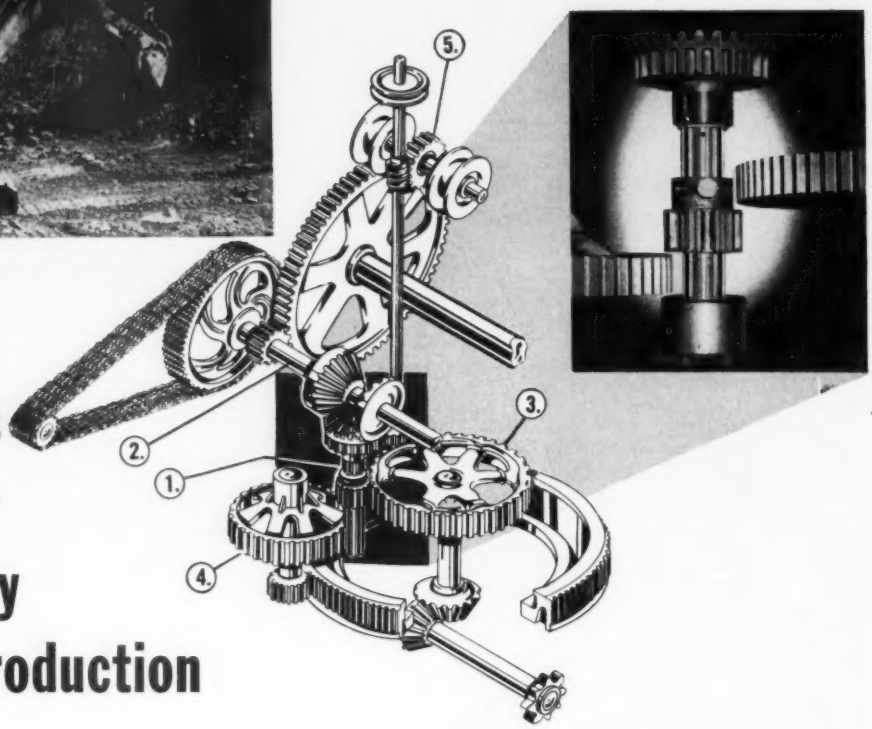
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,977



SERIES 9000

For continuous service . . . highest capacities and coarsest materials. 36- to 84-in. belt widths. Equipped with heavy-duty precision roller bearings.

A fast cycle and a full dipper every pass enable this 2½-yd. Model 3500 shovel to move overburden at top speed for 'round the clock operation. One of the most important factors contributing to a consistently high production rate is the Manitowoc "Power-flo" drive described below.



The key to Manitowoc's extra power is the key to top production

. . . and that extra power is provided through the *exclusive* Manitowoc "Power-flo" slide pinion arrangement that directs the full flow of engine power *only* to the function in operation. There are no power-robbing extra gears moving, even when not in operation (and gears that don't move don't wear out) . . . no complicated trains of gears that hold production down and keep maintenance costs up.

What arrangement could be simpler? As shown in the photograph above, the slide pinion itself is a single, sturdy shaft, spline-fitted with the necessary gears to engage, or disengage the desired function. The slide pinion (No. 1 on the drawing) is driven directly from the drive shaft (2) using only one set of clutches to drive the travel, swing and boom hoist.

With the slide pinion up, the power flows directly from the reversing clutches to the travel gear (3) through the center pin and to the horizontal shaft in the carbody.

With the slide pinion down, the power flows directly to the swing shaft (4) containing the final drive pinion, which meshes with the carbody ring gear.

With the slide pinion in neutral, the reversing clutch is left free to operate the boom hoist (5) if an optional independent boom hoist is not used.

The result is *direct* power to every function . . . a feature found in *Manitowoc* cranes, draglines and shovels. The faster cycle, heavier lifts and bigger bites found in Manitowocs are the direct result of this simple and effective "Power-flo" design. That's why output is *measurably* higher with Manitowoc . . . that's why it will pay you to see your Manitowoc dealer for complete information on the rig best suited to your operation.

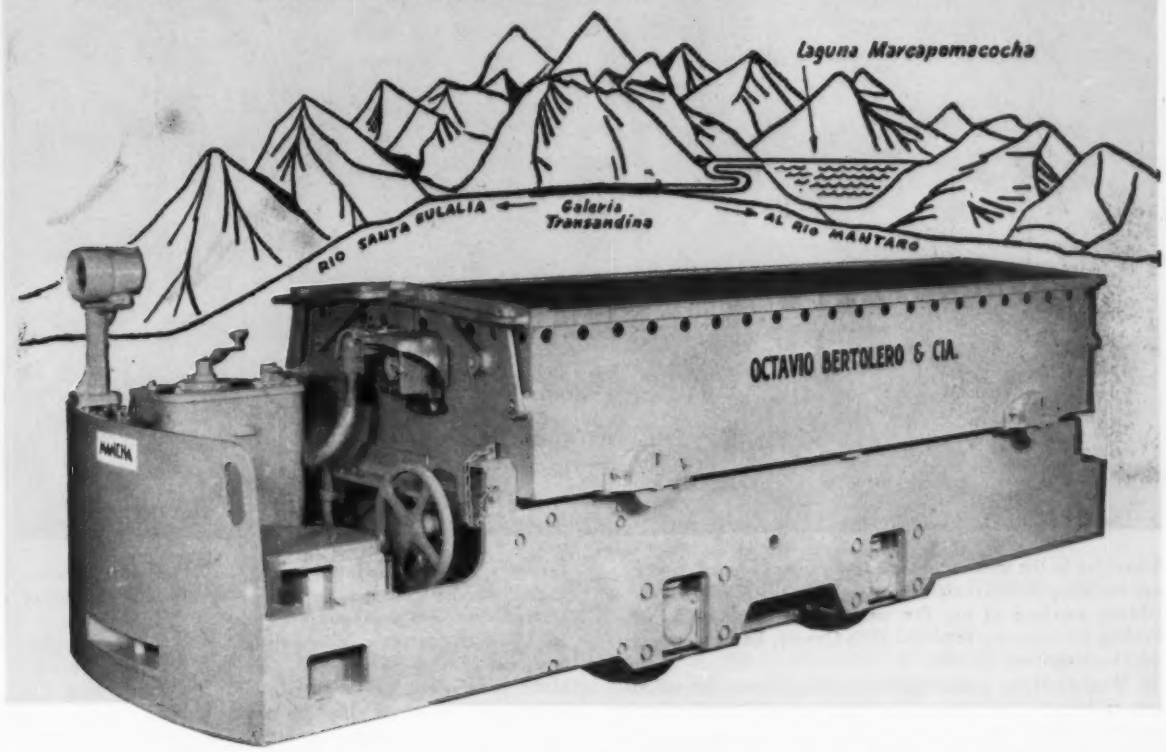
Manitowoc

MANITOWOC ENGINEERING CORP.
(A subsidiary of The Manitowoc Company, Inc.)
MANITOWOC, WISCONSIN

CRANES	SHOVELS	DRAGLINES	TRENCH HOES
20 TON - 100 TON	1-YD. - 5½-YD.	1-YD. - 6-YD.	1-YD. - 2½-YD.

Called on for power and speed...14,000 ft. up

in Peru's Rugged Andes Mountains



MANCHA STORAGE BATTERY LOCOMOTIVES

High in the rugged Andes Mountains, Mancha Storage Battery Locomotives are helping to drive a tunnel that will eventually result in additional electric power for Lima's booming metropolitan area.

A project of the Lima Light and Power Company and Energia Hidro-electrica Andina SA, the tunnel will tap water from the Atlantic watershed—release it down the western slope of the Andes into the Santa Eulalia and Rimac Rivers . . . feeding a series of hydro-electric plants as it flows to the Pacific. This increased water flow will allow expansion of existing installations . . . provide more power.

The tunnel is being driven at an elevation of 14,200 feet. Each of two headings will be 17,400 feet in length. In considering locomotives for the job, careful attention was given to motor capacity and the high running speed essential to maintain loading efficiency at headings. The contractor settled on the plus-safety factor, the power and speed of the Mancha Standard ANX Locomotive.

SPECIFICATIONS

Operating Weight	6 tons
Total Horsepower	54
Batteries	91A10 Edison
Running Speeds	6-9 mph
Axle-to-axle drive connection to prevent wheel spinning	

Not many battery locomotive applications are as unusual as this one but Mancha specializes in fitting the right locomotive to your job. Let us know your requirements.

MANCHA STORAGE BATTERY LOCOMOTIVE

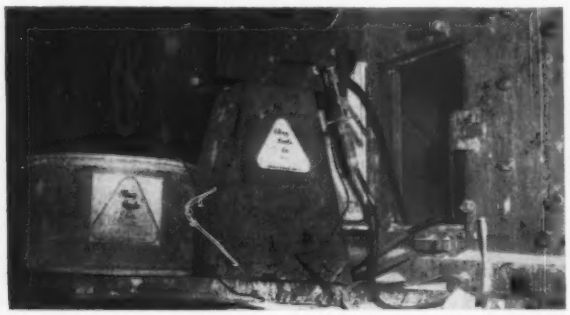
DIVISION GOODMAN MANUFACTURING COMPANY
Halsted Street and 48th Place • Chicago 9, Illinois •
Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.

How semi-automatic hard surfacing saves time and material at Bradford Hills Quarry

"Changing to the semi-automatic application of nickel manganese surfacing material almost saved us the price of the Wear-O-Matic machine in just five weeks," says Thomas Risbon, Welding Foreman for Bradford Hills Quarry, East Petersburg, and Downingtown, Pa.

The Wear-O-Matic unit at Bradford Hills Quarry is used almost exclusively for maintaining their new 57-60 Universal Impactor. Over a five week period, nightly maintenance on this crusher required 500 pounds of 7/64" Wear-O-Matic nickel manganese wire to provide normal operating tolerances. During a similar period, 800 pounds of ¼" nickel manganese stick electrodes were required to provide the same amount of wear protection to the impactors.

Savings in maintenance operations in your industry are important because they affect profits. Find out how the Wear-O-Matic process can help lighten your maintenance load. It's built right and priced right* to provide for you the most efficient maintenance on all equipment subject to wear. Request Bulletin HS-13, Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.



From this platform on the crusher, the Wear-O-Matic unit is used nightly to maintain proper impactor size for most efficient operation.

Weldor Gene Johnson says, "It's easy to turn out square edged impactors like this with the Wear-O-Matic process and, it's less tiring than stick electrodes."

* Price f.o.b. York, Penna. $279.00.

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Mild & Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

New AEROMINE® Promoters for more efficient flotation of silica, silicates,-- improved slime filtration

Developed for use at Cyanamid's own phosphate rock operations, low-cost AEROMINE 3035 and AEROMINE 3037 cationic flotation collectors have proved effective in nonmetallic mineral flotation and shown great promise as filtration aids for clay minerals.

From 0.1 to 0.5 lb. per ton of ore gives excellent recovery on silica and silicate mineral flotation. Combined use with kerosene or fuel oil affords still greater reagent economy. On Florida phosphate rock, AEROMINE promoters are usually diluted with two parts of kerosene to one part of AEROMINE promoter.

AEROMINE 3035 and 3037 Promoters contain the same active ingredient. AEROMINE 3037 is the water-soluble acetate form, while AEROMINE 3035 is the free-base form of the collector. AEROMINE 3035 can be fed as a solution in kerosene, fuel oil or a frother while AEROMINE 3037 can be dissolved in water for feeding, or fed like AEROMINE 3035.

As filtration aids, dosages of 0.2 to 0.5 lb. per ton of feed have materially improved filtration rates, particularly on clays and mineral slimes.

Ask our nearest office to send samples.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
100 Bloor Street East, Toronto 5, Ontario, Canada

CYANAMID DE MEXICO, S.A.
Apartado Postal 222 Mexico 1, D.F., Mexico

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Bush House, Aldwych, London W. C. 2, England

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"Collins Gate" 277 Little Collins Street Melbourne, Australia

Cyanidation Process Chemicals
Flotation Reagents
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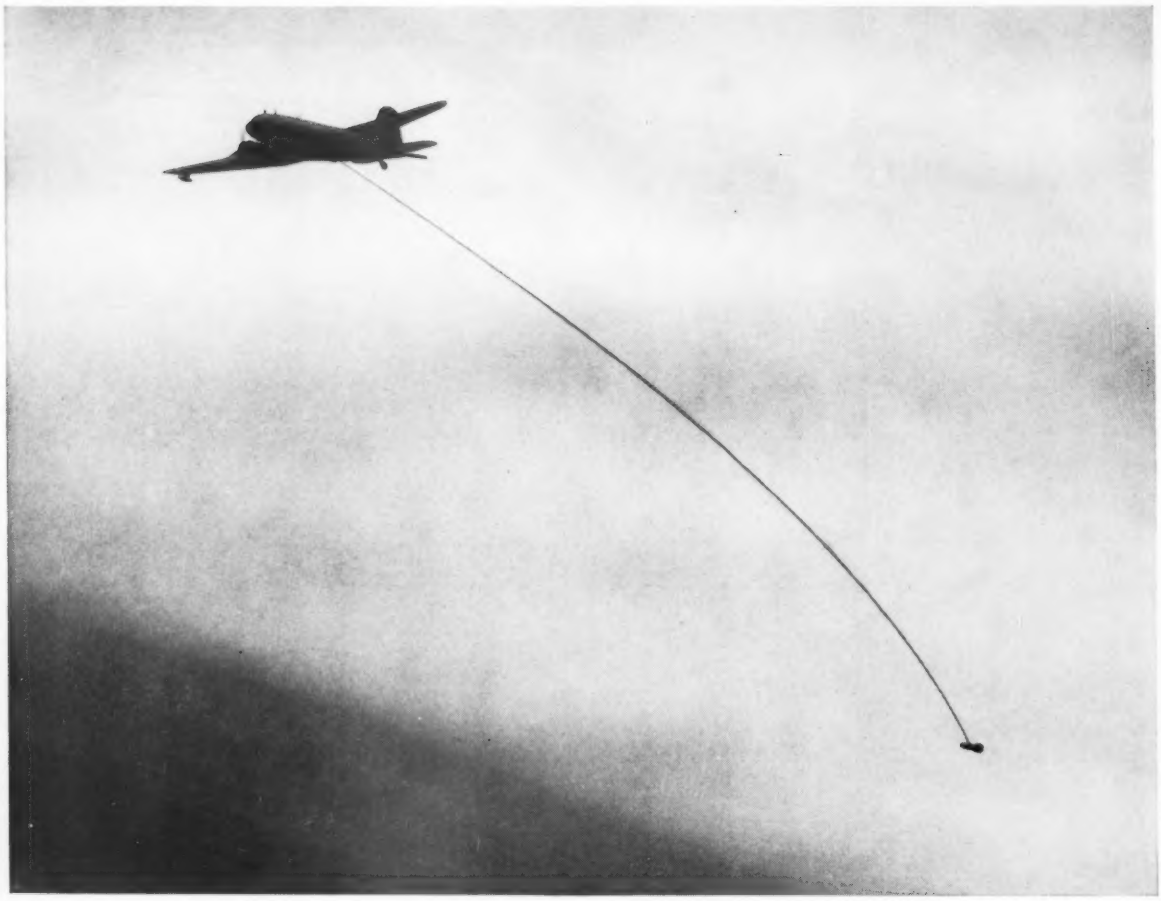
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Powder
Blasting Caps
Electric Blasting Caps
Blasting Accessories



NOW YOU CAN EXPLORE OVER JUNGLE, DESERT OR MUSKEG WITH RADAN-GUIDED AERIAL SURVEYS

Ground stations not needed. Maps, photos not required. Costs cut in half. Surveys speeded.

Now you can obtain dependable aerial surveys over featureless areas previously considered too difficult, if not impossible. AERO SERVICE, who pioneered radio-guided surveys, now offers airborne magnetometer surveys guided by Radan. This tested new radar Doppler aid to navigation operates without ground stations. Maps or photos of the area are not required.

First use of the new system by AERO, in a survey over 40,000 square miles of the Libyan desert, has clearly established its accuracy and utility. (Ground distances can be measured in most cases to within 1 part in 1,000; drift is noted within an accuracy of 0.1°.) AERO will begin another African survey guided by Radan this month.

With Radan, AERO can make magnetic surveys before or during the mapping program, avoiding the usual delay for completion of aerial photography. Reconnaissance over unexplored country is as dependable and technically excellent as lines flown in well-mapped areas.

Costs for Radan-guidance are between $1 and $2 per line mile, reducing total costs of radio-guided surveys by 50% or more.

For more information, write today for *Exploration over Featureless Terrain with Radan Navigation*, AERO's new folder reporting costs, accuracies, other data.

AERO SERVICE CORPORATION

Oldest Flying Corporation in the World

Philadelphia 20, Pa.

AIRBORNE GEOPHYSICAL STUDIES • PRECISE AERIAL MOSAICS • PHOTO INTERPRETATION • RELIEF MODELS • TOPOGRAPHIC AND PLANIMETRIC MAPPING

call KE for plant expansion or new facilities

call KE for plant expansion or new facilities

INGENUITY

has made KE a major engineer-contractor serving

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Ingenuity at work—produces better, faster construction, at lower cost; more efficient and profitable operation.

Ingenuity is a hallmark of Kaiser Engineers—has been for over 40 years of contracting. Experienced KE design and construction engineers can advance your new plant plans from conversation to completion, quickly, at lower cost. Or, they can undertake any single part of a project. One contract can cover all.

With your first thought of expansion, call KE. At Kaiser Engineers, you receive the benefits of sound experience plus creative ingenuity that makes your new plant faster, cheaper, better.

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Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

"Our first 24's stripping record sold us on our

—Luttjohann Stone Co., Topeka, Kansas

"When our first Torque-Converter TD-24 went to work in November, 1957 it stripped 50% more overburden than its steering-clutch competitor," reports John Luttjohann, Luttjohann, Stone Co., Topeka, Kansas. "It cut our stripping costs per yard so much, we bought our second one in June, 1958.

"Now the two TD-24's are giving us lower stripping costs than we've had in recent years, in the face of generally higher costs. The Torque-Converter '24's' are superior machines, powerful enough to push big loads in all conditions, even when frequent heavy rain made a swamp of the quarry.

"'24's' are fast, so we can make the long pushes pay off. And '24's' are trouble free. We haven't lost any time with these two machines in almost 2,000 hours of the roughest work in the quarry."

Luttjohann Co. compared performance!

The Luttjohann's proved by direct comparison that their Planet Power-steered TD-24 could rip and strip 50% more overburden than a 20-ton steering-clutch competitive rig.

Planet Power steering eliminates load-limiting "dead-track drag," keeps full-time "live" power on both tracks. You don't "half-kill" your power and traction to control the TD-24—on turns as you must with any king-sized steering-clutch tractor. You get bonus-load follow through—and don't spill the extra-profit yardage with "jerky" steering.

You can "adjust" TD-24 track speed to assure full-bite performance, benching or highwalling—where steering-clutch rigs can only "nibble"!

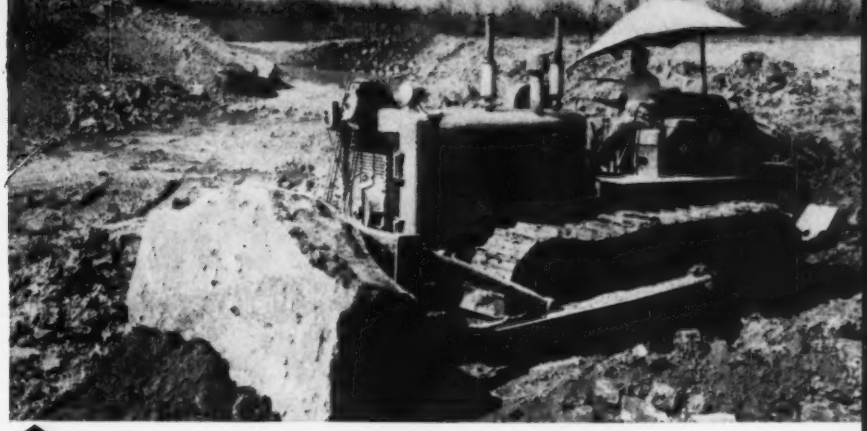
Prove the big yardage increase you can get with a Planet Power-steered International TD-24. Measure the capacity increases you also get with this Hi-Lo, full-power planetary shifting. Check the fast production-boosting TD-24 reverse speeds. Ask your International Construction Equipment Distributor for a demonstration!

International® Construction Equipment

International Harvester Co., 180 North Michigan Avenue

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

economy second"



With the ripper-equipped Torque-Converter TD-24, the Luttjohann quarry rips tough rock layers into movable spoil. They push slabs of rock as heavy as 40 tons, with the blade. Daily crusher output average is about 1,000 cu. yd.

One TD-24 sells another by outproducing a king-sized competitive crawler by an amazing 50%—stripping overburden in side-by-side comparisons at Luttjohann Stone Co., Topeka, Kansas! Here are their Torque-Converter "24's!"

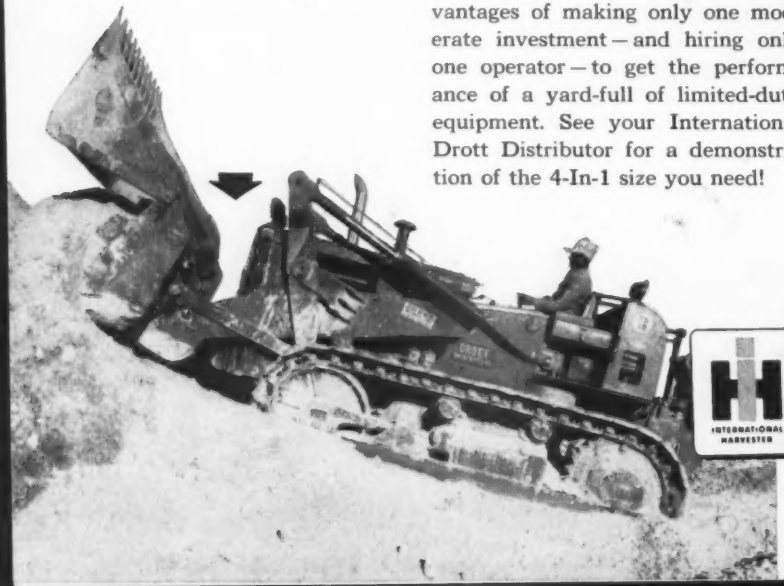
Exclusive clam-action loaders pay big on shovel-type jobs

"Back-dragging" with exclusive clamshell action, the 3 cu. yd. TD-20 4-In-1 pulls down stratified layers of material by the truckload. This unit replaces big-capacity power shovel performance—loads out a 12 yd. truck *in only three fast passes.* In addition, this unit's clamshell action picks up and loads brush, stumps and boulders —provides earth-rolling bulldozer action for haul-road maintenance!

4-IN-1 acts like "40-IN-1" replacing costly, limited-duty rigs!

Simply lift the clam lip hydraulically with fingertip control—and full-capacity, big-yardage bulldozer action (with speedy Shuttle-Bar control) is instantly at your service. The TD-20 4-In-1 shown below is stockpiling 6 to 8 cu. yd. of material per pass. You'd need a bona fide, full-sized blade outfit—or a fast-swinging dragline—to match the 4-In-1's earth-moving performance as a bulldozer!

Nimble International Drott 4-In-1's are snatching profitable jobs from "under the buckets" of far costlier boom-type rigs. Find out why! Get in the driver's seat. See what it means to command built-in clamshell, "carry-type scraper," bulldozer, and famous Skid-Shovel action. Measure the advantages of making only one moderate investment—and hiring only one operator—to get the performance of a yard-full of limited-duty equipment. See your International Drott Distributor for a demonstration of the 4-In-1 size you need!



Sticky clay quits sticking in the bucket—quits gumming the works and slowing production—when you use 4-In-1 clamshell bottom-dumping. Opening the clam pulls sticky materials from bucket surfaces—gravity does the rest, to give the 4-In-1 fast, positive self-cleanout. Even clinging materials that stop conventional "single-action" buckets cold are "duck soup" for the 4-In-1's clam action!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL®
DROTT

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT
This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.
This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
282 Park Avenue, Worcester 2, Mass.

Please send..... Bulletin 130

Name.....

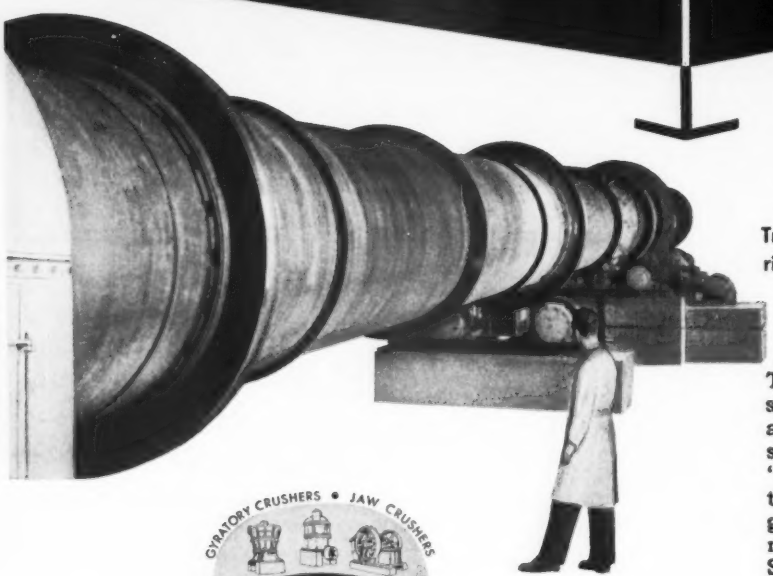
Company.....

Address.....

Traylor-made kilns

feature Operating Economy
Advance Design
Rugged Dependability

Traylor Rotary Kiln operating around the clock.



Traylor Rotary Kiln showing riding rings and thrust roller mechanism.

Traylor is the recognized leader in designing and building rugged dependable Rotary Kilns. From the quality steel plate of the kiln shell and the "full-floating" type of roller ring to the drives and firehood — Traylor guarantees a satisfied customer. For more on Traylor Kilns, Coolers and Slakers write for Bulletin No. 1115.

GYRATORY CRUSHERS • JAW CRUSHERS
Traylor
ROTARY KILNS • BALL MILLS • APRON FEEDERS

TRAYLOR ENGINEERING & MFG. CO., 1121 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

Maintaining steady production at Ayrshire Collieries Corp. Harmattan Mine

Stripping 80′ or more of overburden to reach the coal seam is a rugged job at Ayrshire's Harmattan Mine near Danville, Ill. Two Bucyrus-Erie walking draglines with 25 yd. and 30 yd. buckets are handling the job. Both rigs are equipped with Yellow Strand Wire Rope—including 2″ twin hoist lines, right and left lang lay 2½″ drags and 1⅜″ dump lines. At last report, Yellow Strand Wire Rope was giving excellent yardage, and was still going strong.

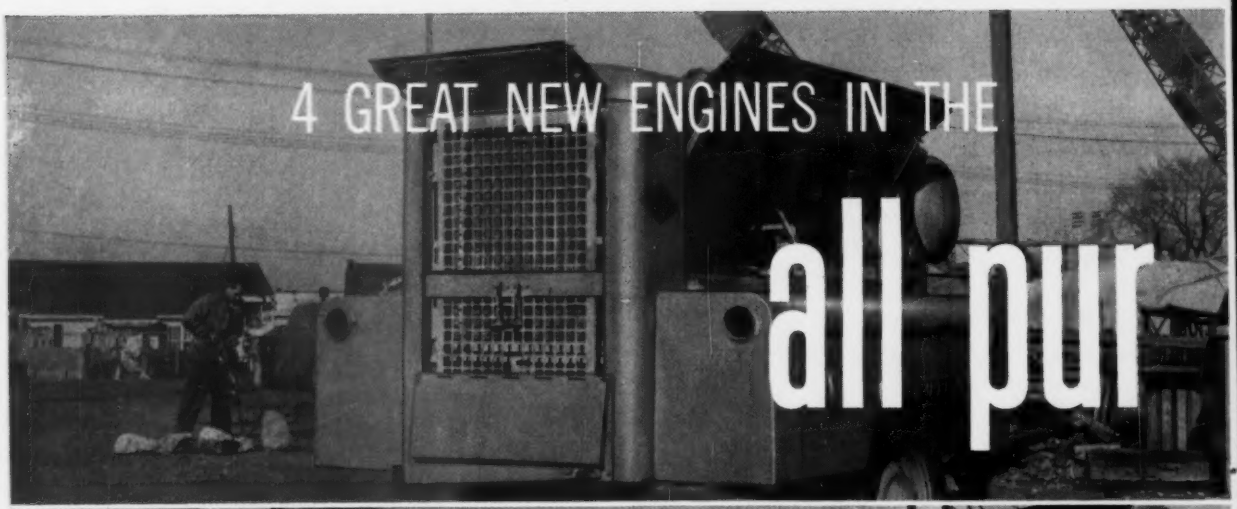
LONG LIFE . . . LOW OPERATING COST . . . are the reasons for this Yellow Strand preference.

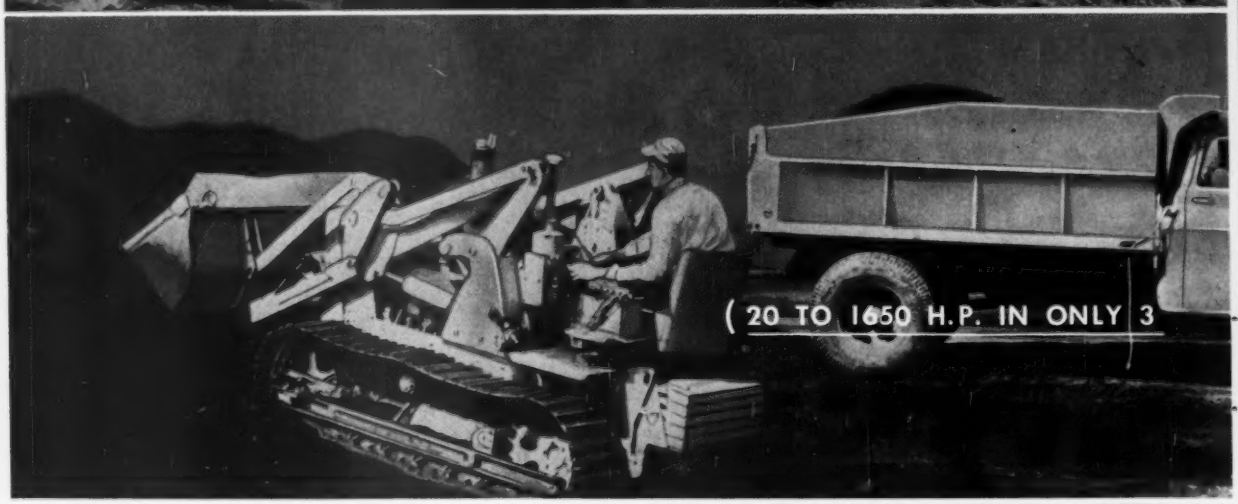
To take advantage of this extra value, call your Yellow Strand Wire Rope distributor today!

Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

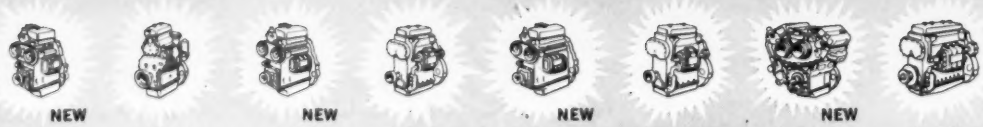
Yellow Strand®

WIRE ROPE SLINGS CLIPS

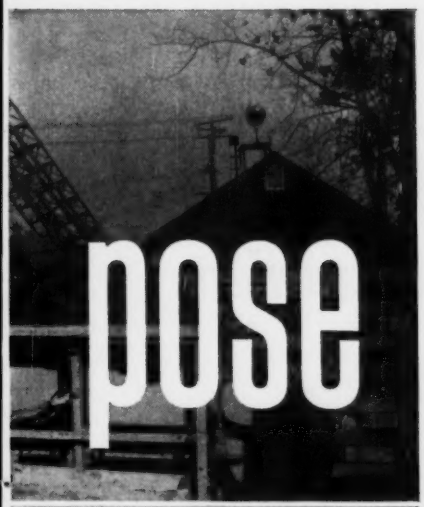


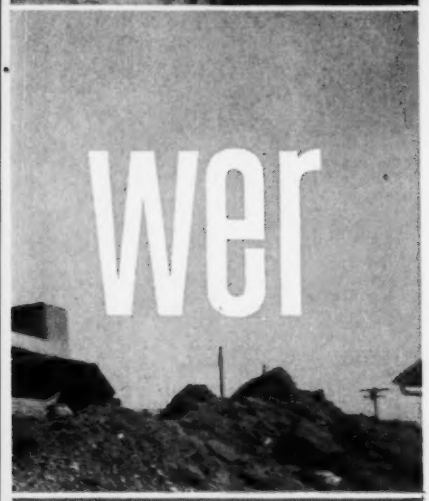


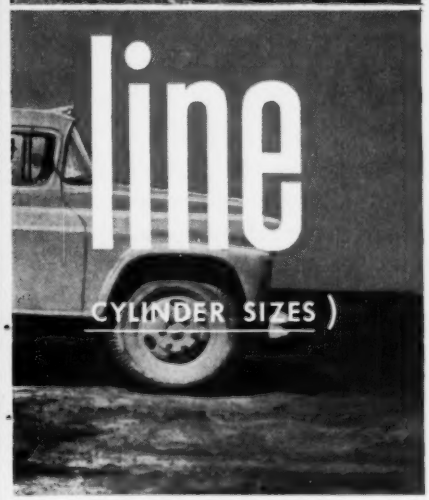
THE GM DIESEL ALL-PURPOSE POWER LINE
20 to 1650 H.P.
in only 3 cylinder sizes



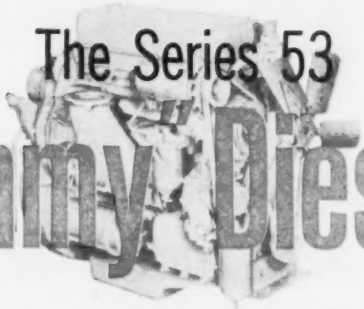
NEW		NEW		NEW		NEW	
"2-53" 20 to 47 H.P.	"2-71" 33 to 67 H.P.	"3-53" 38 to 97 H.P.	"3-71" 51 to 118 H.P.	"4-53" 51 to 130 H.P.	"4-71" 69 to 167 H.P.	"6V-53" 76 to 195 H.P.	"6-71" 112 to 252 H.P.







The Series 53 "Jimmy" Diesels



NEW FOR THE MINING INDUSTRY

Smaller and more compact 2-, 3-, 4-, and V-6 cylinder engines based upon the dependable GM Series 71 Diesel

New as tomorrow is the power concept which GM Diesel has embodied in its All-Purpose Power Line to give you more pay-off from your pay dirt.

Using only 3 cylinder sizes, GM Diesel engineers have more than doubled the number of basic engines—vastly increased the power range—yet maintained the famous GM Diesel family relationship and parts interchangeability.

This concept is dramatically illustrated in the Series 53 "Jimmy" Diesel. For *only* in these Diesels are combined *all* the profit-making, cost-saving advantages *any* Diesel has ever had.

Compare them horsepower for horsepower:

> They cost less, weigh less, take up less room. Accelerate faster, last longer, and parts cost less. They're easier and less expensive to repair and maintain—far more efficient, too.

All these advantages add up to high earning power and real operating economy. Put a Series 53 "Jimmy" Diesel to work. It will pay for itself amazingly fast when it takes over from a gasoline engine.

This Series 53 "Jimmy" Diesel is *literally* All-Purpose Power in the 20- to 195-H.P. range. Consider it for your needs. Write GM Diesel, Dept. M-2, Detroit 28, Michigan, and see what these new Series 53 "Jimmy" Diesels can mean to your mining profits.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada:
GENERAL MOTORS
DIESEL, LIMITED,
London, Ontario

Parts and Service
Worldwide

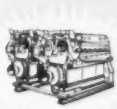
NEW
"6V-71"
112 to 252 H.P.

NEW
"8V-71"
150 to 334 H.P.

"6-110"
160 to 335 H.P.

NEW
"12V-71"
224 to 504 H.P.

NEW
"16V-71"
300 to 675 H.P.



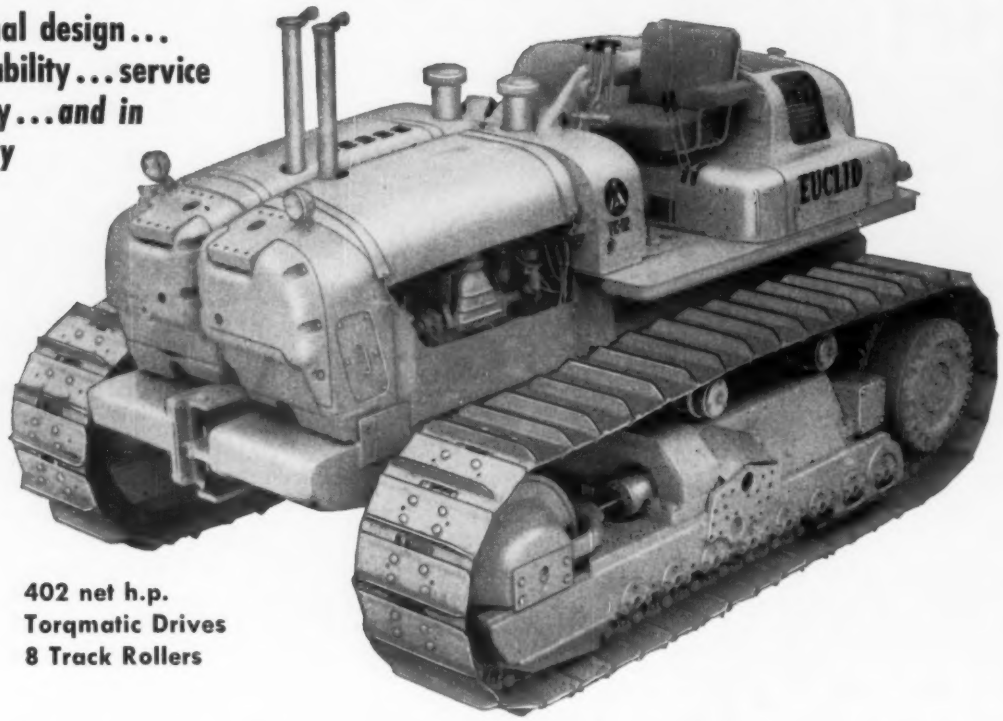
NEW
"24V-71" (Twin 12)
448 to 1008 H.P.

NEW
"32V-71" (Twin 16)
600 to 1350 H.P.
(Turbocharged—1650 H.P.)

New Series *Euclid TC-12* . . .

now even further ahead of other crawlers

in functional design . . . maneuverability . . . service accessibility . . . *and in work-ability*



402 net h.p.
Torqmatic Drives
8 Track Rollers

Ever since the TC-12 was introduced, there has been no question about its top performance ability —even on the toughest crawler jobs. Now with over 3 years of field experience on practically every kind of operation, major product improvements make the new TC-12 better than ever.

Powered by two engines, there's a total of 402 net horsepower delivered to the power train through separate Torqmatic Drives for each track. Big 27″ shoes and 8 rollers give the TC-12 good balance with or without heavy duty dozer blades and other mounted equipment. Bare weight of the tractor has been increased to 67,000 lbs. as a result of heavier construction and more rugged components throughout.

With independent track drives, there's no dead track drag when turning—maneuverability of the big TC-12 with its full power shift saves seconds on every cycle whether push loading scrapers, dozing or pulling big equipment. With unitized assembly, good design of component location and equipment mountings, this "Euc" provides easy accessibility for service and maintenance.

Have your Euclid dealer give you all the facts on the new TC-12 . . . you'll find its your best buy by far where big tractor performance is needed.

EUCLID DIVISION of GENERAL MOTORS, CLEVELAND 17, OHIO

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

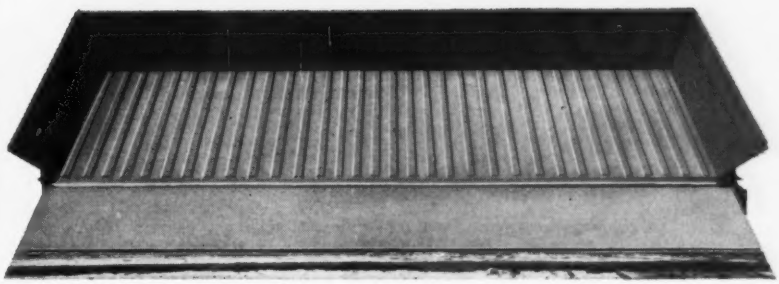
FOR MOVING EARTH, ROCK, COAL AND ORE

MAGOR ...for dependable surface mining..

Magor Automatic Air Dump Cars have set the pace for years throughout the mining industry for fast, efficient low cost service. Magor Cars are specially designed and built to take the rough, tough treatment of mining operations.

Through less maintenance, longer operating life and all 'round dependability, Magor Air Dump Cars save time and money on the job. An outstanding reason why Magor built automatic air dump cars are high on the preferred list of the nation's mining interests.

The 43 cubic yard, 100 ton capacity Air Dump Car shown here is but one of a large quantity recently furnished for a Taconite Mining operation in Minnesota. This car is equipped with a replaceable floor wearing surface of 1" thick low alloy, high tensile steel bars. These bars together with the 3/4" low alloy, high tensile steel floor afford the necessary strength to withstand the punishment of the hard rugged Taconite service.



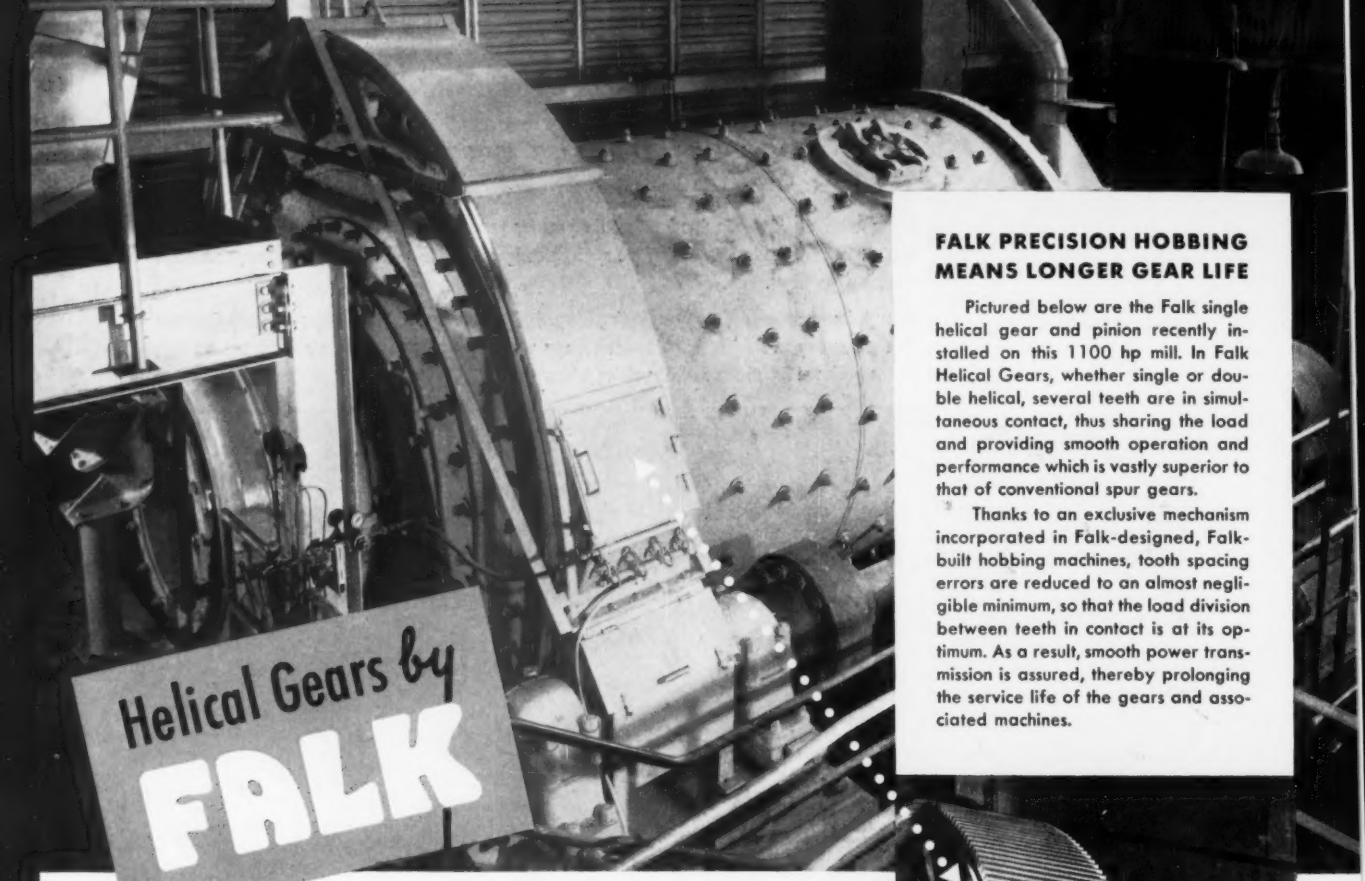
MAGOR CAR CORPORATION

Designers and Builders for the Mines & Railroads of the World

50 CHURCH STREET, NEW YORK 7, N.Y.

MANUFACTURERS OF:

AIR DUMP CARS • ORE CARS • GONDOLA CARS • FLAT CARS • SPECIAL PURPOSE CARS • COVERED HOPPER CARS • HOPPER CARS • BOX CARS



FALK PRECISION HOBBING MEANS LONGER GEAR LIFE

Pictured below are the Falk single helical gear and pinion recently installed on this 1100 hp mill. In Falk Helical Gears, whether single or double helical, several teeth are in simultaneous contact, thus sharing the load and providing smooth operation and performance which is vastly superior to that of conventional spur gears.

Thanks to an exclusive mechanism incorporated in Falk-designed, Falk-built hobbing machines, tooth spacing errors are reduced to an almost negligible minimum, so that the load division between teeth in contact is at its optimum. As a result, smooth power transmission is assured, thereby prolonging the service life of the gears and associated machines.

Helical Gears by FALK

...your Best Buy in gears!

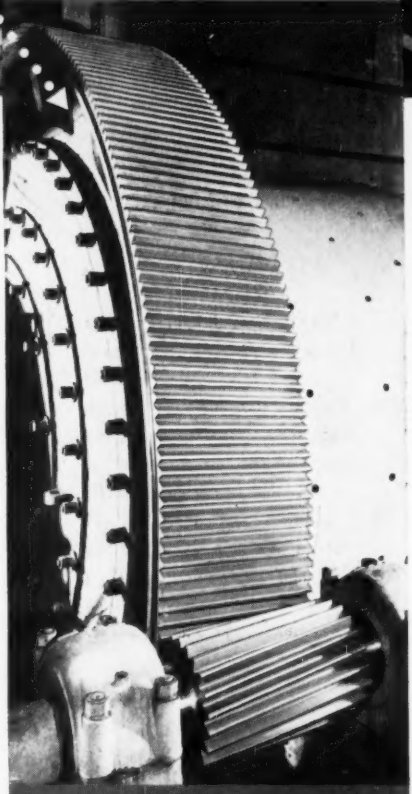
In these times of industrial expansion and modernization, Falk Helical Gearing is more than ever the first choice of experienced, economy-minded users of gear-driven equipment.

This increasing preference is the result of proved performance. Falk Helical Gears and Pinions provide *better performance over a longer service life* because they are correctly engineered...their accurately generated teeth have extra depth and extra capacity...gear efficiency, as shown by actual test data, is 98+%...the highest you can buy!

Other superior features include: high reduction ratios which permit use of higher motor speeds for greater efficiency and reduced power costs; maximum resistance against abrasive wear; smooth, helical gear action. All these factors contribute to the long service life of trouble-free operation for which Falk gears are famed the world over.

When expanding or remodeling your production facilities, it pays to remember that the performance of your equipment will not be any better than the performance of the gears that drive it. So, if uninterrupted production is important to you, specify Falk Helical Gears. They're available in sizes up to 18 ft. in diameter...in capacities up to 2000 hp.

Consult any Falk representative—also, write for
Engineering Report 6170, "Advantages of Helical Gearing."



FALK

...a good name in industry

THE FALK CORPORATION, 3001 W. CANAL ST., MILWAUKEE 1, WIS.

Representatives in Most Principal Cities

In carrier landings, planes coming in at more than 100 knots are stopped in a split second. This amazing performance is made possible by having each plane hook onto one of several wire ropes stretched across the flight deck. Both plane and rope receive an almost unbelievable shock at the moment of contact. Needless to say, only top-quality wire ropes can be used for this application because . . .

you can't bargain with safety

While your use of wire rope differs from this carrier application, *safety should be just as important to you.* For, although a "bargain" rope may save you money, it can cost you your peace of mind. So don't bargain with safety. Buy a rope that's a *quality* rope—buy Wickwire Rope. 5049

WICKWIRE ROPE — A CF&I PRODUCT

CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

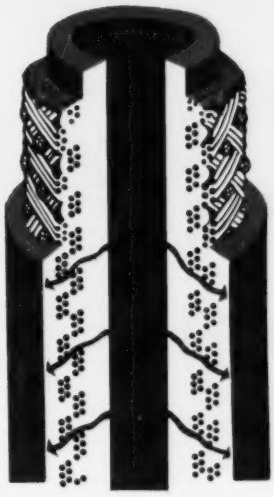
LOOK FOR THE YELLOW TRIANGLE

THE COLORADO FUEL AND IRON CORPORATION—Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New Orleans
New York • Philadelphia

R/M HOMOFLEX HOSE LASTS LONGEST on the toughest jobs

Homoflex Air Hose is the easiest handling hose made for use with air drills. Light, rugged and "flexible as a rope", it's engineered to take the beating of rough jobs . . . and last longer than any other hose. Homoflex Air Hose is mandrel-made with *no* pre-set twist. It coils and uncoils freely in any direction *without* kinking . . . without causing internal strain that can lead to hose rupture and hose failure! The exclusive Homoflex construction provides a homogeneous, inseparable tube-to-cover bond that further increases hose life. Uniform inside and outside diameters assure faster, easier, *safer* coupling . . . faster, fuller flow.

Homoflex Air Hose is also available for extra heavy duty and with yellow cover stripe for visibility; also in types for water, other fluids, and gases. Homoflex features result in lower costs for a wide range of job requirements. Let an R/M representative show you how you can get longer, trouble-free service—"More Use per Dollar"—with Homoflex Hose and other types of R/M hose.



ONLY R/M OFFERS

HOMOFLEX

CONSTRUCTION

More flexible and lighter than any other hose for equal pressure.

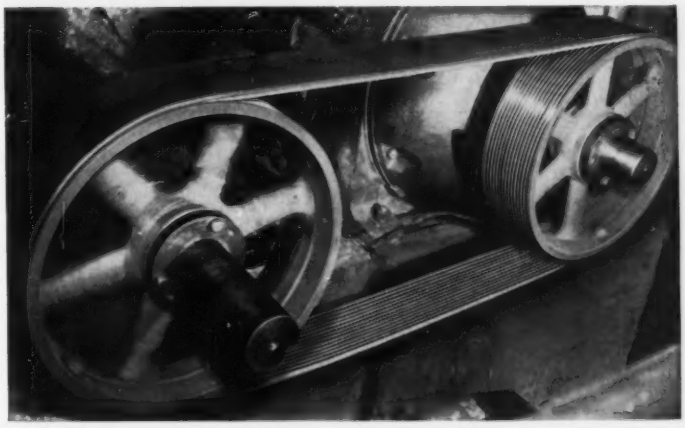
- SUPER-STRONG
- PRECISION BUILT
- FLEXIBLE AS A ROPE
- LIGHT WEIGHT

Note in cross section how specially designed braid permits the rubber tie-gum to penetrate and bond the braided plies during the plastic stage of vulcanization. This results in an inseparable tube-to-cover bond. Write for Bulletins M694 and M610.

"More Use per Dollar"

RAY-MAN CONVEYOR BELT TRAINS BETTER

Ray-Man has the extra flexibility to train naturally, trough easily . . . handle heavier loads. Cushioned strength members *plus* double compensation to relieve outer-ply stress—top *and* bottom—absorb load impact and greatly prolong belt life. Ray-Man really *holds* fasteners, is highly rip resistant . . . requires no breaker strip! Exclusive "XDC" Cover protects against wear, tear, cuts and abrasion. Check advantages of Ray-Man for your job . . . Other types include extra-cushioned Homocord for severe shock loading, and R/M Tension-Master for long lifts, high tensions. Write for Bulletin M302.



R/M POLY-V® DRIVE ELIMINATES BELT MATCHING

Single unit belt (*not* an assembly of V-belts), across full width of the drive-sheave eliminates belt "length-matching" problems. Equipment downtime and belt replacement costs are minimized. Patented Poly-V Drive has *twice* the tractive surface of a V-drive, and delivers up to 50% *more* power in the same space or *equal* power in as little as ⅔ *the space!* Just *two* cross sections of Poly-V Belt meet *every* heavy duty power transmission requirement. Greater power delivery and drive dependability begin when you specify R/M Poly-V* Drive for your mine fans and other equipment. Write for Bulletin M141.

*Poly-V is a registered Raybestos-Manhattan trademark.

RMB14

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

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RM

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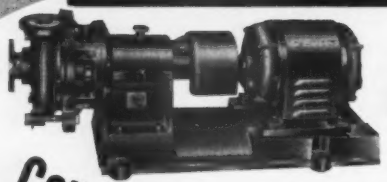
SAND PUMPS

WILFLEY



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INDIVIDUAL ENGINEERING ON EVERY APPLICATION

E & M J Annual Average Metal Prices—1897 to 1958

Year	COPPER (a) Domestic Refinery	COPPER Foreign Refinery	LEAD Common N. Y.	ZINC Prime Western (b) E. St. Louis	TIN (c) N. Y.	SILVER (e) N. Y.	QUICK-SILVER (f) N. Y.	ALUM-INUM Ingot
1897	11.29	.....	3.580	4.120	13.67	59.790	38.50	39.00
1898	12.03	.....	3.780	4.570	15.70	58.260	40.70	30.58
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	20.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301(d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.866	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	20.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	20.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.299	94.735	89.099	290.348	23.668
1956	41.818	40.434	16.013	13.494	101.409	90.826	259.923	26.010
1957	29.576	27.157	14.658	11.399	96.261	90.820	246.978	27.516
1958	25.764	24.123	12.109	10.309	95.127	89.044	229.057	26.890

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99% in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for 11 months. (e) New York market. . . . All quotations in cents per lb, except for silver, which is in cents per troy oz, and (f) quicksilver, which is in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1958.

E&MJ Meta

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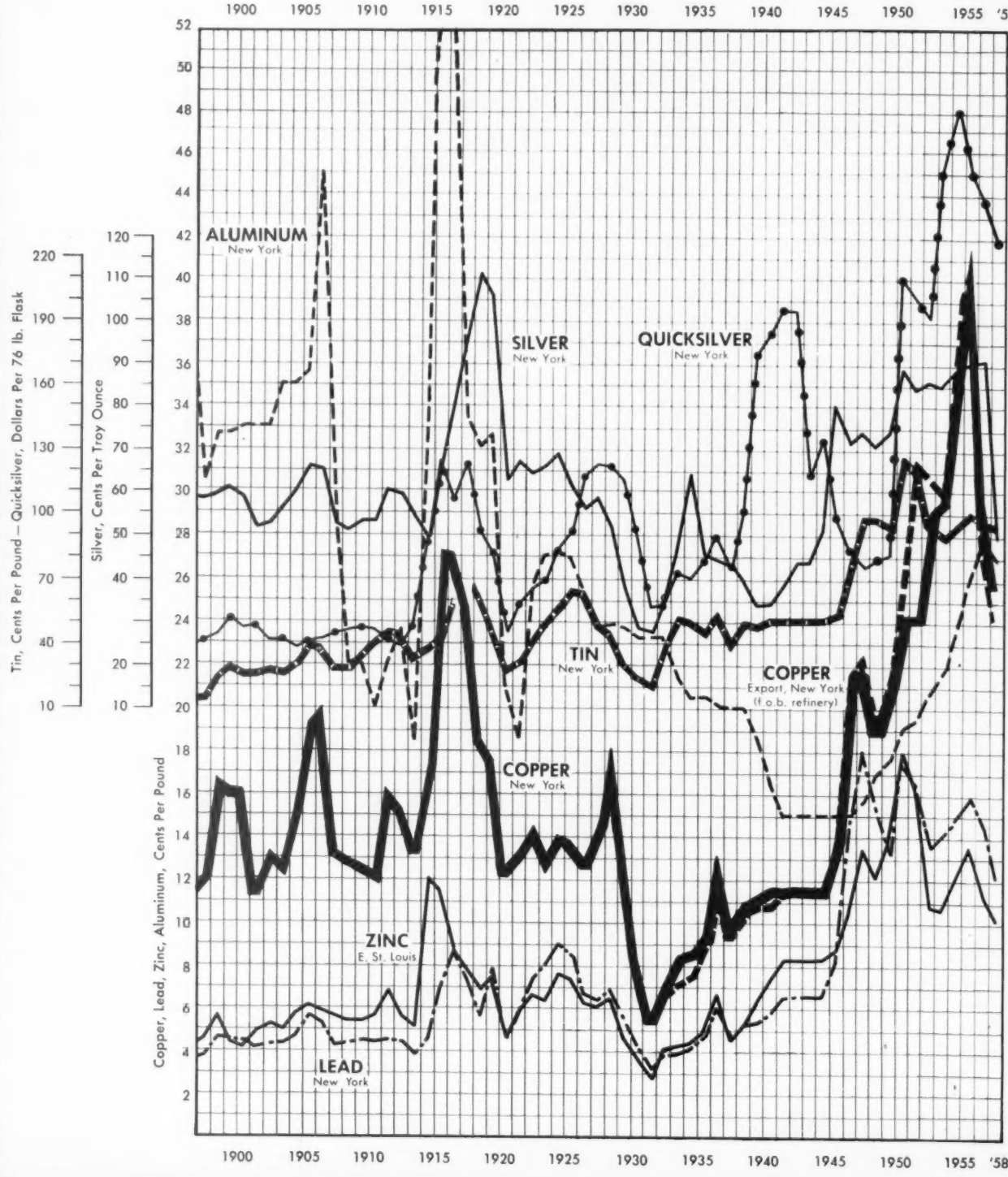
Annual Averages—1897-1958



tal Prices

al and E&MJ Metal and Mineral Markets

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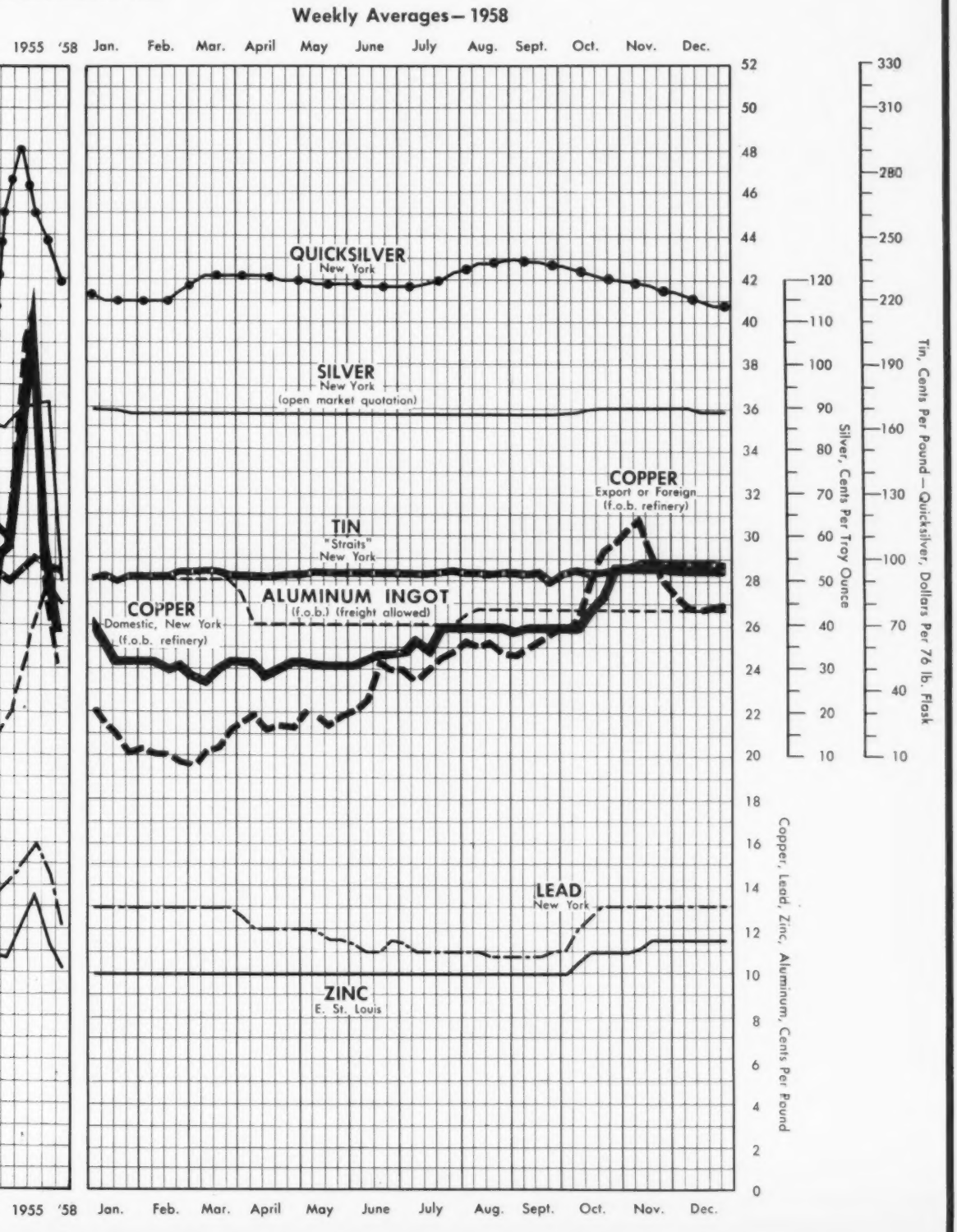
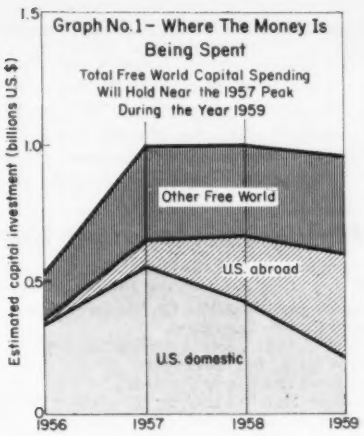
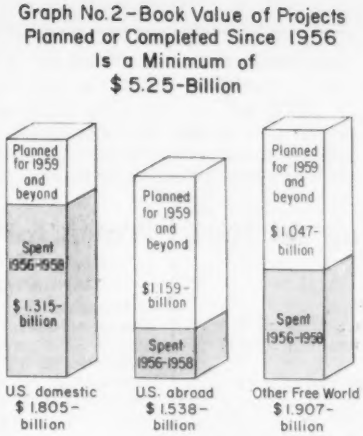
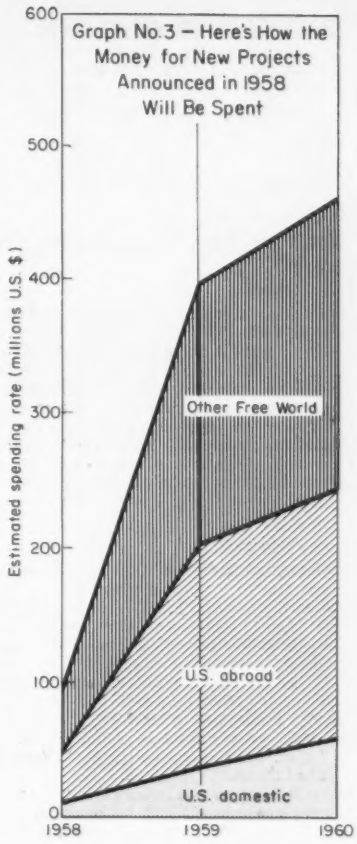

Weekly Averages—1958
1955 '58 Jan. Feb. Mar. April May June July Aug. Sept. Oct. Nov. Dec.
QUICKSILVER
New York
SILVER
New York
(open market quotation)
COPPER
Export or Foreign
(f.o.b. refinery)
TIN
"Straits"
New York
ALUMINUM INGOT
(f.o.b.) (freight allowed)
COPPER
Domestic, New York
(f.o.b. refinery)
LEAD
New York
ZINC
E. St. Louis
Copper, Lead, Zinc, Aluminum, Cents Per Pound
Silver, Cents Per Troy Ounce
Tin, Cents Per Pound—Quicksilver, Dollars Per 76 lb. Flask
52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
120 110 100 90 80 70 60 50 40 30 20 10
330 310 280 250 220 190 160 130 100 70 40 10
1955 '58 Jan. Feb. Mar. April May June July Aug. Sept. Oct. Nov. Dec.

E & M J Weekly Average Metal Prices—1958

	COPPER		LEAD	ZINC	TIN	SILVER	QUICK-SILVER	ALUM-INUM
	Domestic Refinery	Foreign Refinery	N. Y. Common	E. St. Louis Prime Western	N. Y. "Straits"	N. Y.	N. Y.	99% plus, Ingot
Jan. 8	26.330	22.350	13.000	10.000	92.771	89.850	223.000	28.100
15	25.370	21.621	13.000	10.000	93.208	89.825	220.000	28.100
22	24.510	21.113	13.000	10.000	91.438	89.625	220.000	28.100
29	24.485	20.225	13.000	10.000	93.167	88.825	220.000	28.100
Feb. 5	24.515	20.438	13.000	10.000	93.042	88.625	220.000	28.100
12	24.488	20.233	13.000	10.000	92.950	88.625	220.000	28.100
19	24.490	20.100	13.000	10.000	93.604	88.625	220.000	28.100
26	24.215	19.875	13.000	10.000	94.875	88.625	225.000	28.100
Mar. 5	24.290	19.704	13.000	10.000	94.688	88.625	229.333	28.100
12	23.785	20.338	13.000	10.000	95.854	88.625	232.000	28.100
19	23.630	20.538	13.000	10.000	94.625	88.625	232.000	28.100
26	24.170	21.358	13.000	10.000	93.729	88.625	232.000	28.100
Apr. 2	24.480	21.771	12.667	10.000	93.021	88.625	232.000	27.433
9	24.470	22.042	12.000	10.000	92.729	88.625	232.000	26.100
16	24.435	21.300	12.000	10.000	92.583	88.625	232.000	26.100
23	23.870	21.533	12.000	10.000	92.958	88.625	230.000	26.100
30	24.165	21.475	12.000	10.000	93.708	88.625	230.000	26.100
May 7	24.395	22.104	12.000	10.000	94.188	88.625	230.000	26.100
14	24.255	22.029	11.917	10.000	95.000	88.625	229.000	26.100
21	24.255	21.629	11.500	10.000	94.521	88.625	229.000	26.100
28	24.270	21.990	11.500	10.000	94.479	88.625	229.000	26.100
June 4	24.344	22.221	11.300	10.000	94.600	88.625	229.000	26.100
11	24.580	22.795	11.000	10.000	94.896	88.625	228.000	26.100
18	24.820	24.500	11.018	10.000	94.542	88.625	228.000	26.100
25	24.805	24.150	11.500	10.000	94.667	88.625	228.000	26.100
July 2	24.925	24.105	11.333	10.000	94.500	88.625	228.000	26.100
9	25.488	23.640	11.000	10.000	94.175	88.625	228.000	26.100
16	25.140	24.185	11.000	10.000	94.104	88.625	229.000	26.100
23	26.080	24.780	11.000	10.000	95.646	88.625	230.000	26.100
30	26.100	24.975	11.000	10.000	95.917	88.625	233.000	26.100
Aug. 6	26.110	25.475	11.000	10.000	95.625	88.625	235.000	26.605
13	26.100	25.245	11.000	10.000	95.250	88.625	238.000	26.800
20	26.100	25.300	10.750	10.000	94.229	88.625	238.000	26.800
27	26.100	24.890	10.750	10.000	94.854	88.625	239.000	26.800
Sept. 3	25.988	24.835	10.750	10.000	94.975	88.625	240.000	26.800
10	26.065	25.180	10.750	10.000	94.521	88.625	239.000	26.800
17	26.085	25.470	10.750	10.000	95.458	88.625	239.000	26.800
24	26.100	25.825	11.000	10.000	91.021	88.625	237.000	26.800
Oct. 1	26.100	25.910	11.135	10.000	94.625	88.925	237.000	26.800
8	26.125	26.480	12.030	10.466	96.583	89.125	235.000	26.800
15	26.675	28.445	12.600	11.000	96.025	90.000	233.000	26.800
22	27.250	29.500	13.000	11.000	96.292	90.375	232.000	26.800
29	28.715	29.795	13.000	11.000	97.125	90.375	231.000	26.800
Nov. 5	28.706	30.405	13.000	11.000	97.656	90.250	230.400	26.800
12	28.663	30.895	13.000	11.185	99.000	90.125	229.000	26.800
19	28.695	29.445	13.000	11.500	99.150	90.125	228.000	26.800
26	28.665	28.200	13.000	11.500	99.350	90.125	224.000	26.800
Dec. 3	28.594	27.545	13.000	11.500	99.156	90.125	224.000	26.800
10	28.550	26.925	13.000	11.500	99.100	90.125	222.000	26.800
17	28.590	26.835	13.000	11.500	99.000	89.725	220.000	26.800
24	28.590	26.975	13.000	11.500	99.000	89.875	218.000	26.800
31	28.600	27.119	13.000	11.500	98.583	89.875	218.000	26.800




Graph No. 2 – Book Value of Projects Planned or Completed Since 1956 Is a Minimum of $ 5.25-Billion
Planned for 1959 and beyond
Spent 1956-1958
$ 1.315-billion
U.S. domestic $ 1.805-billion
Planned for 1959 and beyond
$ 1.159-billion
Spent 1956-1958
U.S. abroad $ 1.538-billion
Planned for 1959 and beyond
$ 1.047-billion
Spent 1956-1958
Other Free World $ 1.907-billion



Capital Spending Plans Hold the Line for 1959

JAMES W. FRANKLIN

E&MJ's ANNUAL REVIEW of mine, mill, smelter and refinery developments shows that capital investment by the mining, and metal and mineral processing industry in the Free World continues to hold the line at about $1-billion a year.

Our survey by commodity, locality, company, size and estimated cost, as presented on the following pages, shows that a minimum of $5.25- billion has been added to the book value of the mining industry through projects announced or completed since 1956.

Since the survey now has a four-year foundation, we are able to show certain minimum trends which have been graphically displayed here. We say "minimum" trends and expenditures for the mining industry, because we do not include any of the following situations in our survey—steel plants, nonferrous fabricators, limestone, sand and gravel, projects not reported to *E&MJ*, projects for which the company has made no public announcement of estimated cost, exploration shaft sinkings, exploration costs, and small mines without mills.

For example, in 1957 more than 30 shaft sinkings took place in Canada without producing a single mine. And during the recent U.S. uranium boom, more than 1,000 small mines were started. None of these expenditures are included in the survey. Several steel mills are noted in the list but we have included them only for their strategic value to the mining industry of the locale. Their capital costs have not been included in our survey. We do not include research and development, either in the exploration and development of a mine or in research for new processes, in the survey.

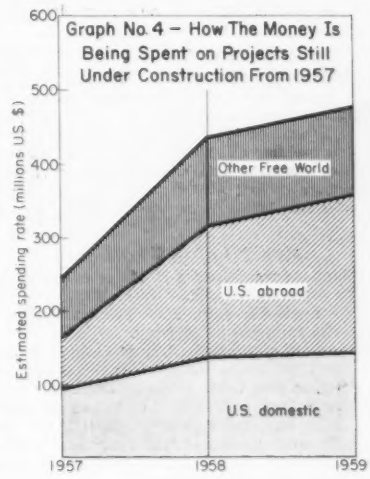
Here is what we are able to show—

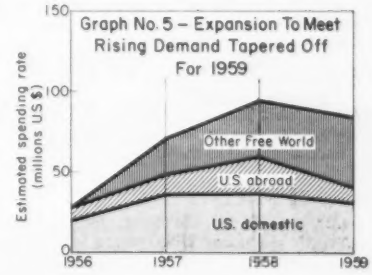
Graphic No. 1. Where the money is being spent—since 1957, the Free World has been capitalizing in the mining industry at the rate of about $1-billion a year. Without adding projects that may be announced and started in 1959, we know that $962-million will be spent to start, complete and expand projects. U.S. industry will spend more abroad in 1959 than it will at home.

Graph No. 2. Book value of projects planned or completed since 1956—since 1956, the domestic industry has planned or spent a total of $1.805-billion, while U.S.-owned projects outside the nation have a value of $1.538-billion for the same period. Other Free World projects since 1956 come to a total of $1.907-billion. Based on unfinished projects and newly announced planning during 1958, more will be spent outside the U.S. than in it.

Graph No. 3. Mining needs long range planning—without adding a single new project in 1959, the industry will spend $861-million in 1959 and 1960 just to work on new projects announced in 1958.

Graph No. 4. It takes many years





to complete a large project—projects still under construction since 1957 will require about $478-million in 1959.

Graph No. 5. Expansion plans to meet rising demand tapered off for 1959—more than half of the planning in 1959 will be for U.S. firms, at home and abroad. By expansion we mean capacity added to existing projects and modernization programs.

Following is *E&MJ's* survey by commodity and status. Please note the regular all-important "Watch For" section where we attempt to point out areas where important new projects may already be in the planning stage.

Expansion Programs Going On Here

IRON

India. Tata Iron & Steel Co. A $240-million project.
Copper Cliffs, Ont. International Nickel Co.'s $20-million iron recovery plant is about half finished and has more than 200,000 tpy capacity. Inco is producing 68% Fe pellets.
Sorel, Que. Quebec Iron & Titanium started an expansion program in 1957 to be completed in 1959 at a cost of $16-million. Eight furnaces are onstream with capacity of 350,000-tpy titanium-slag.
Eagle Mountain, Calif. Kaiser Steel Corp. began an expansion program in 1957 and intends to spend $194-million at Fontana.
Marquette, Mich. Humboldt Mining Co. (Ford Motor and Cleveland-Cliffs) plans to add a 640,000-tpy pelletizer.

COPPER

Majdenpek, Yugoslavia. Loan of $40-million has been made for a new refinery to treat Bor's 30,000-tpy blister production.
Northern Rhodesia. Mufulira in 1957 began an expansion program to reach 155,000-tpy metal output by 1962. $39.6-million cost.
Townsville, Queensland, Australia. Mt. Isa Mines Ltd. is expanding refinery to produce wire and rod. An electrolytic refinery of 33,000 tpy output goes onstream in 1959. Present production is 40,000 tpy; next goal is 56,000; total forecast is 70,000.
Toledo, Philippines. Atlas Mining & Development Co. is doubling Toledo capacity at a cost of $2.5-million.
El Cobre, Chile. Cie Miniere de M'Zaita has modernized and enlarged the mill to 1,100 tpd.
Chile. Paipote smelter increased blister production capacity to 19,800 tpy; plans to have 22,000 tpy by end of 1959.
Ashe County, N.C. Appalachian Sulphides will double milling capacity to 800 tpd ore.
Garfield, Utah. Kennecott Copper Corp. is spending some $7-million on Garfield; plan to raise electrolytic production to 21,000 tpm.

ALUMINUM

Kidricevo, Yugoslavia. Pechiney will assist Kidricevo and Lozovac in raising alumina and aluminum capacity.
Jamaica. Bauxite production is expected to reach 6-million tpy by the end of 1959. Alumina Jamaica with 500,000 tpy at Kirkvine is building a 230,000-tpy facility at Ewarton.
Baie Comeau, Que. Canadian-British Aluminium Co. is expanding from present 45,000 tpy to 90,000 (due in 1959).
Massena, N.Y. Alcoa will add third modern potline.

MISCELLANEOUS METALS

South Africa. Western Holdings expanded to 150,000-tpm gold ore.
Porcupine, Ont. Aunor Gold Mines increased mill to 600 tpd.
Northwest Territory. Giant Yellowknife will raise gold milling capacity from 760 to 1,000 tpd.
Lynn Lake, Manitoba. Sherrit Gordon Mine has raised milling rate to 3,500 tpd to maintain metal production and treat low-grade.
Mexican Hat, Utah. Texas-Zinc Minerals has new contract with AEC to mill an additional 13,000 tpm of custom ore. AEC plans to raise U.S. milling rate by about 3,000 tpd in the Plateau area. No other contracts or extensions have been signed as yet.
Moab, Utah. Uranium Reduction is adding an alkaline leach circuit at a cost of $2.5-million.
Salt Lake City, Utah. Vitro Uranium Co. completed the conversion to solvent extraction flowsheet at a cost of $1.2-million.
Inspiration, Ariz. Inspiration Copper completed the moly plant.
Climax, Colo. American Metal Climax is putting the finishing touches on a $34-million mine and mill expansion.
Norway. Titania A/S plans a $10-million expansion to yield 300,000 tpy ilmenite concentrate.
Albany, Ore. Oregon Metallurgical Corp. is spending $1-million.
Springfield, Ore. National Metallurgical Co. will double silicon production at cost of $500,000.

NONMETALS

California. H. M. Holloway, Inc. increased agricultural gypsum production at Lost Hills mine to 3,500 tpd.
Gabbs, Nev. Basic, Inc. is spending $1-million.

Watch for Major Development Here

MANGANESE

Bechuanaland. Marlime Chrysotile Asbestos Co. has concession.
Western Australia. Union Carbide has options.
Jamaica. Jamaican Mining Co. Ltd. hopes to develop two mines.
Costa Rica. M. W. Hardy & Co., Inc. has deposits.
Mexico. M. A. Hanna has seen some large properties.
Woodstock, N. B. Strategic Materials is trying to negotiate finances for Udy Process plant to produce 70,000-tpy ferromanganese.

IRON

Swaziland. One leading mining house is reported to have put in $9.8-million in investigating properties.
Liberia. Landsell K. Christie, president, National Iron Ore Co. Ltd., sees 200-million ton reserves; while Johnstone Avery, president, Liberian-American Swedish Minerals Co., sees an equal amount in their holdings.
South Australia. Broken Hill Pty. Ltd. has lease. Areas outside BHP lease holds some 30-million tons reserves.
Tasmania. Rio Tinto has discovered some 100-million tons on the Savage River.
Brazil. M. A. Hanna is prospecting around St. John d'el Rey. Japanese-Brazilian group has government go-ahead on 500,000-tpy mine and mill. Government will allow iron exports to rise to 8-million tpy in 1959; 20- to 30-million later.
Chile. Minera Santa Fe (Isbrandtsen) has 1-billion tons in Antofagasta. Estimated capital cost would be $250-million.
Ecuador. Koppers, Strategic Materials and Universal Mineral Resources may build Udy Process plant of 500,000 tpy capacity.
Honduras. Government is seeking European aid to develop mines.
Ontario. Anaconda Iron Ore (Ontario) Ltd. is said to be getting serious about production.
Papaonga Lake, Ont. El Sol Mining has orebody.
Wabush Lake, Que. Iron Ore Co. of Canada visualizes a $150-million pelletizer and mine.
Mt. Wright, Que. Normanville Mining Co. (J&L and Cleveland-Cliffs) has 335-million tons. Process may be dry electrostatic.
Quebec. Oglebay Norton Co. has option on Atlin Ruffner Mines property. Reserves estimated at 1.5-billion tons to 500 ft depth.
Alaska. House Rule 6785 permits iron ore mining in the Chilkat River area. Senate must also pass.
Marquette, Mich. If the Humboldt project is successful, Ford Motor may develop other pelletizers in the area.
Newton Falls, N.Y. W. S. Moore Co. is drilling. If reserves are sufficient, Moore sees a 300,000-tpy mine and pelletizer.
Negaunee, Mich. Marquette Iron Mining Co. has large deposit.
Iron County, Wis. J&L Steel has lease on 2,000 acres.
Wyoming. U.S. Steels' Columbia-Geneva Div. will most likely go ahead on $16-million mine and pelletizer.

COPPER

Southern Rhodesia. Sanyati Mines Ltd. says reserves are 15-million tons, 1.4% Cu, plus Pb and Zn.
Tasmania. Montana Silver-Lead, NL has two large copper-nickel orebodies; one will be underground, other open pit.
Jamaica. Jamaican Mining Co. Ltd. has property in Bellas Gate area.
Mexico. Anaconda Co. has large orebody under the Cananea mine.
Cerro Blanco, Chile. Cerro de Pasco continues to drill. Reserves are now 80-million tons, 2% Cu. If developed, project would cost some $90-million, including 28,000-kw hydroelectric plant, 6-mile tunnel, 10,000-tpd mine and flotation plant, smelter and townsite.
Northwest Territory, Canada. Consolidated Mining & Smelting is investigating Conwest Expl. Nekana property.
Mattagami, Que. New Hosco Mines has some ore.
East Pima, Ariz. Banner Mining Co. has large low-grade orebody.
Wakefield, Mich. American Metal Climax has proven over 100-million tons, 1.25% Cu.
Minnesota. At least three large companies are bidding for leases in St. Louis, Cook and Lake Counties for copper-nickel.

ALUMINUM

Belgian Congo. Syndicate Aluminga is studying bauxite deposits. Still in the planning state for the middle Congo is a 7-billion kw

hydroelectric plant and a 250,000-tpy aluminum pot line. If it goes as scheduled, plant will be built during 1964 to 1966.

Ghana. Kaiser has made survey of possible Volta River hydroelectric plant and aluminum industry.

Australia. Reynolds Pacific Mining is prospecting. Commonwealth Aluminium Corp. Pty. Ltd. has some 200-million tons of bauxite in the Weipa area. Commonwealth, owned by Consolidated Zinc and British Aluminium, sees either a $100-million alumina plant at 500,000 tpy output; or a $450-million integrated aluminum potline at 250,000 tpy metal.

Brazil. Kaiser is studying possibility of a smelter here.

Panama. Both Alcoa Minerals, Inc. and Kaiser Exploration Co. have concessions.

Lake DeSmet, Wyo. Reynolds Mining Corp. exercised options for potential power site and reduction works.

GOLD

South Africa. Plans are being made to develop the Zandpan deposit. In Transvaal and the Orange Free State there are seven potential mines that could be brought in at a cost of $200-million.

Bolivia. Natomas is drilling Bol-Inca property in Beni State. This may be the world's richest placer. South American Gold & Platinum will have one dredge running by mid 1959.

Beauceville, Que. Large placer being drilled.

LEAD-ZINC

Western Canada. Pine Point to Slave Lake railroad will cost up to $75-million. Cominco has large deposit in area.

East Tintic, Utah. Bear Creek has lead-zinc-silver deposit.

Mattagami, Que. Noranda, McIntyre and Canadian Exploration are considering developing Mattagami Syndicate claims. Reserves are 14-million tons, 13.5% Zn, plus copper, silver and gold.

MISCELLANEOUS METALS

Philippines. Congress amended the mining law to allow operators 5 years in which to produce and the government will take only 35% of the net. Large nickel-iron deposit in Surigao holds 130-million tons, 47% Fe and 0.9% Ni.

Maine. Roland F. Beers, Inc. has $71,000 Dept. of Economic Development assistance in drilling for nickel-cobalt orebody.

North and South Dakota. International Resources Co. has proposal before AEC for 600 tpd lignite uranium mine and mill.

Southern Rhodesia. Bikita Minerals has developed substantial tonnage of low-grade beryl ore.

Powderhorn area, Colo. Dr. Warren Wagner, consultant geoglogist of Du Pont, says that the area holds from 15- to 20-million tons of columbite ore.

Echo Twp., Sioux Lookout, Ont. Rio Canadian Explorations has a promising moly find.

Maranboy, NT, Australia. Area holds potential for 500 tpd of tin ore.

Congo. Societe Minetaire du Congo Francais will mine modest, but high-grade cassiterite deposit.

NONMETALS

Montana. Brazil Creek Bentonite Co. has deposit said to run 26-million tons of bentonite.

South Africa. De Beers will explore for diamonds in Namaqualand and Van Rhynsdorp holdings.

Sahara Hoggars, Africa. Diamonds, platinum, nickel and copper strikes have been reported by exploration team.

Stem, N. C. Carolina Pyrophyllite Co. may build mine and mill.

Projects Announced or Starting Construction in 1958

IRON

Minas Gerais, Brazil. Brazilian-Japanese group, National Steel Co. and Vale do Rio Doce Iron Co. plan a 500,000-ton mine and concentrator (cost $57-million).

Sao Paulo, Brazil. Kaiser Industries has started construction of $150-million steel plant for Cie. Siderurgica Paulista.

French Equatorial Africa. Societe des Mines de Fer de Mekambo will spend $350-million to open high-grade deposit by late 1964. Project includes 460-mile railway and will yield 10-million tpy by 1967. Bethlehem Steel owns 50%.

French Guinea. Hoesch Werke, AG has acquired 5% interest in Cie. Miniere de Conakry's 2.5-million ton deposit.

Rourkela, Orissa, India. Japanese government has extended $8-million in yen credit to develop mine.

Barsu, Orissa, India. Hindustan Steel Ltd. will have mine and 6,000 tpd mill. Reserves are 150-million tons, 54 to 65% Fe.

Trinidad. Caribbean Iron Mines Ltd. will open in 1959. Reserves are 20-million tons of high-grade iron ore.

Copiapo, Chile. Mitsubishi will spend $555,555 to develop two iron mines in Atacama at 300,000-tpy rate. Two ore carriers will cost another $10.6-million.

Algarrobo, Chile. Compania de Acero del Pacifico has purchased property and will produce by 1960.

Nahuatl, Colima, Mexico. Estimated 53.8-million ton magnetite orebody will be exploited. Cost will be at least $4.8-million. Government is investigating the Krupp-Renn and Udy Process.

Monterrey, Mexico. M. W. Kellog will build a second "HyL Process" plant for direct reduction of ore. 500 tpd output. Fierro Esponja, S.A. will operate.

Acari, Peru. Pan American Commodities, S. A. has $8.5-million loan to develop mine.

Mt. Wright, Que. Quebec Cartier (U.S. Steel) has awarded contract for 163-mile railway and 60,000 hp hydroelectric plant as first step forward production from Lac Jeannine. Pelletizer will yield 8-million tpy. Cost will be $300-million.

Ungava Bay, Que. Cyrus S. Eaton and Krupp interests will share 50-50 in Ungava Iron Ores Ltd. First production is due in 1961 at rate of 500,000 tpy of partially refined pellets. Rate will be 2-million tpy by 1962; 5-million eventually. In excess of $200-million.

Wabush Lake, Labrador. Pickands-Mather & Co., heads group, which has ordered a 42-mile railroad into mine. Estimated project cost is $100-million.

Dillon, Colo. Minerals Engineering Co. will build an $8-million, 3,000 tpd ore and 1,000 tpd pelletizer.

Gilbert, Minn. Rhude & Fryberger plan 300,000 tpy pelletizer.

Wisconsin. Ashland Mining Co. contemplates a pelletizer and mine to cost from $35- to $50-million. Three or four other projects are in the works for Hurley-Park Falls area with total cost of about $200-million.

COPPER

Chile. Empresa National de Fundiciones will go ahead with $12-million, 30,000 tpy blister smelter. Second and third stages to follow will ultimately develop 80,000 tpy blister capacity.

ALUMINUM

French Guinea. Olin-Mathieson, Pechiney, Ugine, British Aluminium and Aluminium AG (Swiss) have financed $135-million alumina project of 480,000 tpy capacity. Reserves are 1.5-billions tons. Target date is 1960.

French Guinea. Loan of $70-million to finance 150,000 typ aluminum refinery has been obtained. Societe de l'Aluminium de Guinee (Pechiney, Ugine, Aluminium Ltd., Olin-Mathieson, British Aluminium, Aluminium AG and Aluminium Werke of Germany) will operate.

Uttar Pradesh, India. Aluminum plant will be built near Pipri (Rihand Dam) with target capacity of 20,000 tpy. First half will be onstream by 1961. Government, Birla Bros. and Pechiney involved.

Paracas, Peru. Cerro de Pasco Corp. plans an aluminum reduction works and is studying the power potential of the Mantaro River (estimated at 785,000 kw).

Caroni Falls, Venezuela. Venezuelan Development Corp. has budgeted $1.5-million to spend on preliminary plans for 25,000 tpy now, 50,000 later alumina plant. Cost is estimated at $30-million.

GOLD

Orange Free State. Riebeeck Mines is sinking shaft on double reef formation. If upper reef is payable, then General Exploration Free States gets rights to lower one.

Beni State, Bolivia. South American Gold & Platinum's subsidiary South American Placers, Inc. is installing dredge, and will spend about $3-million to get into production.

Florence Basin, Idaho. Idaho Mining & Milling Co. has more than 30 miles of stream bed. Company expects to install 2,000 cubic yd bucketline dredge.

Coaldale, Nev. Argenta Co. will process tailings from old gold-silver camp at Candelaria.

Nye County, Nev. Goldfield-Rand Co. plans to handle 5- to 10,000 yd per day with bucketline dredge.

ZINC

Noyelles Godault, France. Full size zinc blast furnace to be installed by Penarroua Co.

Irapuato, Mexico. Government announced plans for a $3-million, 30- to 40-tpd electrolytic refinery.

Kellogg, Idaho. Bunker Hill Co. announced plans for a $10-million fertilizer plant with 200,000 annual ton capacity.

URANIUM

Chile. Mining Credit Bank and Empresa Nacional de Fundiciones formed corporation with $150-million capital to exploit radioactive mineral deposits.

(*Continued*)

MISCELLANEOUS METALS

Loveland, Colo. Mineral Concentrates, Inc., will refine beryl ores from Crystal Mountain area in $250,000 mill.
Colorado. Estes Park Beryllium Corp. plans a 200-tpd beryl mine and concentrator.
Colorado. American Beryl Corp. started 100-tpd mine and beryl concentrator.
New Milford, Connecticut. Mag Mining Corp. has acquired beryl properties and plans to have 50-tpd mill in 1959.
Cincinnati, Ohio. U.S. Industrial Chemicals Co. is building 1-tpm columbium-tantalum pilot plant.
Val d'Or, Que. Quebec Lithium Co. still plans $3-million lithium refinery using Quebec Dept. of Mines process.
Prineville, N. M. Verdenhoff Mining Co. expects to mine cinnabar in 1959 and will build 240-tpd roaster.
Blind River, Ont. Dow Chemical Co. and Rio Tinto formed Rio Tinto Dow Ltd. and will spend $1-million to produce 100 to 200 tpy of thorium concentrates from uranium mill tailings.
Exton, Pa. Foote Mineral Co. will erect a commercial transistor-grade silicon facility.

NONMETALLICS

Baie Verte, Newfoundland. Advocate Mines Ltd. will spend $1-million to explore and develop an asbestos orebody. Plans are for a 3,000-tpd mine and mill by 1962 (Cost $20-million.).
French Equatorial Africa. Pacific Tin Co. and its subsidiary Compagnie Miniere de l'Oubanqui Oriental will develop alluvial diamond placers.
Nevada. Eagle-Picher put $2-million, 36,000-tpy diatomaceous earth plant onstream.
Southern Rhodesia. Lawrence Cantat and Cornelius Oosthuizen found huge gem-quality emerald deposit. A second large deposit has since been discovered.
Rittman, Ohio. Morton Salt Co. will sink shafts in 1959.
Apex, Nevada. Fibreboard Paper Products Corp. has indicated reserves of 750-million tons of gypsum. Mine can be onstream within a year for less than $1-million.
Vavdon, Chalkis, Greece. Austro-American Co. will invest $800,000 on magnesite mine and mills.

These Projects Are Still Under Construction

MANGANESE

French Equatorial Africa. U.S. Steel and French interests (Comilog) will mine Gabon by 1961 at 1-million tpy. Construction of 280-kilometer railway started. Cost estimated at $67-million.
British Guiana. African Manganese Co. plans to have a property onstream in 1960. Railway cost $7-million (1957).

IRON

Chihuahua, Mexico. Altos Hornos de Mexico spending $28-million (1957) on 500-tpd mine and washer.
El Trueno, Venezuela. Mivenca is spending $52-million (1957) to develop 3.5-million ton project due in 1959; to expand to 7-million tpy by 1962.
Steep Rock, Ont. Inland Steel reports that Caland Ore Co. has passed the half-way mark on the lake drainage. Production is targeted for 1960. C-orebody goes onstream in 1959. 3-million tpy.
Jamestown, Ont. Algoma Ore Properties will have Sir James mine in production in 1959.
Minnesota. M. A. Hanna has plans for washer at Pierce mine where pit is ready and surface auxiliary plants have been erected.
Michigan. M. A. Hanna announced a stretch-out in surface plant construction for Homer-Wauseca. Underground development continued during 1958. Hanna planned to have 700,000 tpy concentrator output in 1959. Cost estimated at $11-million (1957).
Pea Ridge, Mo. Bethlehem Steel and St. Joseph Lead Co. will have $40-million mine and concentrator onstream in 1959.
Conshohocken, Pa. Alan Wood Steel will operate 50-tpd, $3.6-million H-Iron plant in 1959.

COPPER

French West Sahara. Societe des Mines de Cuivre le Mauretanie (Micuma) has completed pilot plant tests on two deposits—30-million tons, 1.5% Cu and 30% Fe with oxide cap running 2.5% Cu and 50% Fe; and 15-million ton, 52% Fe. Railway must be built to Port Etienne, 124 miles away.
Northern Rhodesia. Bancroft is almost pumped out.
Mantos Blancos, Chile. Empresa Minera de Mantos Blancos, SA leach plant construction is on schedule to yield 12,500 tpy in 1959. Open pit at 2,000 tpd.
Freirina, Chile. Paulino Callejas & Sons are building a flotation plant at Quebradita mine.
El Salvador, Chile. Andes Copper has raised cost estimate on El Salvador to $104-million. Mill capacity will be between 20- and 30,000-tpd with first section to operate in 1959. Reserves are 375-million tons, 1.6% Cu. Will yield 100,000 tpy metal.
Antofagasta, Chile. Nippon Mining Co. and Daiichi Bussan Kaisha are developing Portequela open pit to yield 100 tpm contained metal to be refined in Japan. Cost is $1-million.
Toquepala, Peru. Southern Peru Copper Corp. is about 60% complete for 120,000 tpy metal production in 1959. Total cost will exceed $230-million.
Flin Flon, Manitoba. Hudson Bay Mining & Smelting continued to develop Stall and Chisel Lakes orebodies.
Chibougamau, Que. Copper Rand Chibougamau Mines plans to complete 1,500 to 2,500-tpd mine and mill.
Twin Buttes, Ariz. Duval Sulphur will be onstream at 10,000-tpd mine and mill in 1959. Cost was $20-million.
Baltimore, Md. Kennecott has hiked electrolytic refinery capacity to 16,500 tpm. Refinery will be onstream in 1959 to treat Braden concentrate. Cost was $30-million.
Illinois. Hydrometals Inc. is building a 50-tpd rolled-copper-from-cementation-scrap plant. Cost will be $10-million.

ALUMINUM

Lacq, France. Ugine is building a second electrolytic refinery with 23,000 tpy output. In same area, Pechiney is building a 50,000-tpy pot line.
Borneo. Aluminium Ltd. plans a 175,000-tpy bauxite mine.
Orissa, India. Indo-Canadian Indian Aluminium Co. is building 10,000-tpy pot line.
British Guiana. Aluminium Ltd. will have 250,000 tpy, $33-million alumina plant into production in 1959.
Surinam. Aluminum Co. of America is spending $45-million on 150,000-kw hydroelectric installation and planning a 60,000-tpy reduction works which cost $150-million.
Evansville, Ind. Aluminum Co. of America may have $80-million, 150,000-tpy pot line running before the end of 1959.
Pt. Comfort, Texas. Alcoa will complete alumina plant in 1959. Cost will be $45-million. Plant output will be 1-million tpy alumina.
Massena, N.Y. Reynolds Metals Co. will complete the $88-million, 100,000-tpy pot line in 1959.

GOLD

Quebec. Malartic Gold Fields will work dormant Norlartic mine. Reserves are 367,950 tons, 0.16 oz Au.

ZINC

Cockle Creek, NSW, Australia. Consolidated Zinc will have Imperial blast furnace onstream at 47,000 tpy by 1960. Full capacity planned by 1963.
New Brunswick. Brunswick Mining & Smelting suspended work.
Colorado. Clear Creek Mining Co. will open old mine.
Pend Oreille, Wash. Utahcan Inc. is completing mill.

NICKEL

Finland. Outokumpu's Katalahti mine will yield nickel concentrate by 1959 which will be smelted at Harjavalta.
Moa Bay, Cuba. Freeport Sulphur's Freeport Nickel Co. expects to complete $119-million project in 1959. Refinery is in Louisiana. Output will be 50-million lb nickel and 4.4-million lb cobalt a year.
Thompson, Manitoba. International Nickel Co. expects to produce 75-million lb per year from Moak-Mystery Lakes mines, mills and smelter starting in 1961. Total cost including railway and hydroelectric plant will be $175-million.

MISCELLANEOUS METALS

Salida, Colo. Antero Refining Corp. is building commercial beryllium oxide plant.
Montgomery, Ala. Alabama Metallurgical will go ahead on 10,000-tpy magnesium plant to cost $3.5-million.
Wilmington, Del. Allied Kennecott's titanium refinery will use Sorel slag until local supply is developed. Cost will be $40-million.
Australia. South Alligator, NL will have mill onstream by mid 1959.
Kaipokok, Labrador. British Newfoundland Exploration is doing underground development on orebody running about 1% U_3O_8.

NONMETALS

Lacq, France. Gas fields will soon yield 1-2-million tpy sulphur.
Tehuantepec, Mexico. Central Minera, SA is completing a $3.5-million 1,000-tpd Frasch sulphur plant.
Okotoka, Sask. Texas Gulf Sulphur intends to complete a $6-

million, 370-tpd sulphur-from-gas plant in 1959.

Grand Isle, La. Freeport Sulphur's $30-million Frasch plant should start producing in 1960. Plant will use 5.5-million gpd water.

Houston, Texas. American Sulphur Co. is constructing Frasch sulphur plant on a Humble Oil dome.

Saskatchewan. International Minerals & Chemical expects to complete 3,500-tpd mine and potash refinery by the end of 1959. Cost will be $20-million and project will yield 720,000 tpy. At least 14 other companies are active in the province.

Carlsbad, N. M. Farm Chemical Resources Development is preparing a potash mine and refinery.

Neiveli, India. Government in 1956 announced plans for $147-million lignite program.

Georgetown Canyon, Idaho. Central Farmers Fertilizer Co-op is building a 1,500-tpd phosphate rock mine and mill. Cost is $16-million.

Vernal, Utah. Stauffer Chemical is constructing mine, mill and phosphorus furnace with estimated cost at $20-million.

Whiskey Island, Ohio. International Salt Co. is completing a $7.5-million salt mine.

Projects Completed and In Production in 1958

MANGANESE

Pieterburg, Northern Transvaal. Pyrolusite Mining Co. Ltd. opened mine.

Socorro, N. M. Anderson Bros. completed and sold their 1,000-tpd mine. Cost was $150,000.

Pittsburgh, Pa. Pittsburgh Coke & Chemical Co. completed rebuilding job at cost of $2.5-million. Capacity is 400 tpd of high-carbon ferromanganese, or 600 tpd spiegeleisen, or 900 tpd pig iron.

IRON

Saizerais, France. Iron mine and mill opened by Societe des Acieries des Pompey and will have capacity of 900,000 tpy. Further extensions will yield 2-million tpy in future. Reserves are 100-million tons.

Iron Baron, South Australia, Australia. Broken Hill Pty. Ltd. reopened the pit at a cost of $3-million. Production will be 1-million tpy.

Steep Rock, Ont. Steep Rock Iron Mines Ltd. completed Errington concentrator and the one at Hogarth which remained idle. In 1956, Steep Rock began a $60-million program aiming for 5.5-million tpy.

Ottawa, Ont. Hilton mine of Steel Co. of Canada has 600,000-tpy pellet capacity.

Sudbury, Ont. National Steel Corp.'s Lowphos Ore Ltd. completed a $20-million mine and 600,000-tpy (output) mill, but did not begin operations.

Moose Mountain, Ont. M. A. Hanna has a taconite plant completed.

Steep Rock, Ont. Canadian Charleson is shipping from $2-million, 250,000-tpy (output) concentrator.

Aurora, Minn. Erie Taconite is complete at a cost of $300-million. Capacity is 7.5-million tpy of high-grade pellets.

Morgantown, Pa. Bethlehem Steel's Grace mine onstream.

COPPER

Legnica, Poland. Copper smelter of 12,500-tpy capacity and 20,-000-ton sulphuric acid plant onstream.

Avoca, Ireland. St. Patrick's Copper Mines Ltd.'s new concentrator has 4,000-tpd capacity. Reserves are 20-million tons, 1.1% Cu.

Timma, Israel. Production rate at new $10-million mine and leaching plant will be 7,000-tpy metal.

Philippines. Philex Mining Co. put 200-tpd Santo Tomas mill onstream. Concentrate to go to Nippon Mining.

La Africana, Chile. Santiago Mining Co.'s mill onstream at 500 tpd.

Ontario. International Ranwick started production at 125-tpd mill feed. Molybdenite concentrate being sold and copper concentrate going to Noranda.

Chibougamau, Que. Merrill Island Mining Corp. onstream.

Hayden, Ariz. Kennecott Copper Corp. spent $40-million (1956) with modernization of Ray mine and mill and the new smelter at Hayden.

ALUMINUM

Burnside, La. Ormet Corp. completed 345,000-tpy alumina plant.

Clarington, Ohio. Ormet has reduction works on the line. Total project cost was $231-million. Capacity is 180,000-tpy pig.

The Dalles, Ore. Harvey Aluminum has 240 pots (50,000 tpy) at a cost of $44-million.

GOLD

South Africa. Buffelsfontein has 100,000-tpm reduction works at a cost of $5-million.

Winkelhaak, Eastern Transvaal. Union Corp. completed the mill. By mid-1959, capacity should be 60,000 tpm.

Val d'Or, Que. Sullivan Consolidated Mines is back into production after two-year layoff.

ZINC

Santander, Peru. Minerales Santander Inc.'s mine and mill are in production at 500 tpd. Cost was $1.9-million.

Spokane, Wash. Northwest Refining & Chemical Co. completed 24-tpd (output) zinc oxide refinery at cost of $392,000.

URANIUM

Australia. Mary Kathleen Uranium Mines Ltd. (Rio Tinto) onstream at cost of $28-million. Capacity is 1,000-tpy yellow cake.

Pine Creek, Australia. United Uranium, NL converted an old gold mill into a uranium plant.

Canada. All 19 proposed uranium mills are now onstream at total capacity of 43,000-tpd mined and milled.

Bancroft, Ont. Canadian Dyno Mines onstream with 1,000-tpd capacity. Cost was plus $8-million.

Blind River, Ont. Entire Northspan project onstream—Spanish American (2,000 tpd), Panel Consolidated (3,000 tpd) and Nordic Lake (3,000 tpd). Total cost was $75-million.

Blind River, Ont. Stanrock Uranium's 3,000-tpd mine and mill are operating. Cost was $24.5-million.

Blind River, Ont. Milliken Lake Uranium Mines Ltd. is a producer at 3,000 tpd. Cost was $26-million.

Durango, Colo. Vanadium Corp. of America closed Naturita and rebuilt Durango to make up for capacity lost. Now has 750-tpd potential.

Maybell, Colo. Trace Elements mill cost $2.2-million.

Rifle, Colo. Union Carbide's mill has 1,000-tpd capacity and cost $8.5-million.

Grants, N. M. Kermac Nuclear Fuels Corp. mill has 3,300-tpd capacity and cost $16-million.

Grants, N. M. Phillips Petroleum mill cost $9.5-million and has a capacity of 1,700 tpd.

Grants, N. M. Homestake-New Mexico Partners mill onstream at 750 tpd. Cost was $5.3-million.

Grants, N. M. Homestake-Sapin Partners mill at 1,500 tpd. Cost was $10-million.

Lakeview, Ore. Lakeview Mining Co. has 210-tpd mill running. Cost was $2.6-million.

Green River, Utah and Slick Rock, Colo. Union Carbide put two chemical upgraders onstream. Each takes 400 tpd of 0.3% U_3O_8 and upgrades it to 15%.

Riverton, Wyo. Fremont Minerals dual-process mill at 550 tpd. Cost $3.5-million.

Riverton, Wyo. Lucky Mc Uranium Corp. spent $7-million on 750-tpd mill.

MISCELLANEOUS METALS

Angel Peak, Ore. Western Minerals, Inc. has erected a 30-tpd Lacey furnace for mercury ore.

Sudbury, Ont. International Nickel Co. put Levack concentrator onstream at 6,000 tpd. Cost was $12.5-million.

Massachusetts. National Research Corp. is turning out consumable-arc tantalum at 30,000-lb per year rate.

Salmon, Idaho. Salmon River Uranium Development, Inc. put thorium concentrator onstream at 100 tpd.

Batang Berjuntai, Malaya. Pacific Tin Consolidated Corp. spend M$10-million on 900-yd per hour dredge and cleaner for new tin placer lease.

NONMETALS

Pieterburg, Transvaal. W&B Asbestos Co. Ltd. opened asbestos mine.

Eastern Twp., Que. Carey-Canadian has mill at 2,000 tpd asbestos ore capacity by year end.

Eastern Twp., Que. National Asbestos Mines Ltd. at 3,000 tpd. Mine is open pit.

Eastern Twp., Que. Lake Asbestos of Quebec Ltd. (Asarco) open pit and mill cost $36-million. Output is 100,000-tpy fiber.

Bovill, Idaho. J. R. Simplot put $1-million clay plant onstream.

British Columbia. Giant Mascot Mines Ltd. reopened to produce barite from mill tailings.

Colony, Wyo. Archer-Midland Co. completed bentonite mill.

Kimberly, South Africa. De Beers opened $4.2-million, 20,000-tpd diamond cleaning plant.

Davy Crockett Lake, Tenn. International Minerals & Chemical Corp. completed flake mica recovery plant. Capacity is 120 tpd.

Esterhazy, Saskatchewan. Potash Co. of America potash and 4,-000-tpd mill onstream at cost of $20-million.

Minor Metals

Columbium-Tantalum

William R. Barton
U.S. Bureau of Mines

U.S. MINE production of columbium-tantalum mineral concentrate reached a record high for the third consecutive year in 1958. Production, as measured by total weight of columbite-tantalite concentrates and combined columbium-tantalum pentoxide content of euxenite concentrate, was more than 200 tons compared to about 185 tons in 1957. Once again, most of the concentrates were produced from the Bear Valley, Idaho, euxenite - columbite - monazite placer mine of Porter Bros. Corp. Imports of columbium concentrate were 1,938,707 lb, and imports of tantalum concentrate were 873,141 lb during the first eight months of the year, compared to 2,316,230 lb and 413,240 lb, respectively, during the same period in 1957. These figures probably reflected similar changes in world ore production.

Columbium metal production more than doubled over the previous year. Most of the metal was destined for nuclear engineering applications. To achieve the ultra-high purity required for such use, almost all the metal was purified by electron-beam melting at Stauffer-Temescal Co., Richmond, Calif. Fansteel Metallurgical Corp. was again the leading producer of tantalum metal, but received increasing competition from newer producers such as Electro Metallurgical Co., Kawecki Chemical Co., Kennametal, Inc., National Research Corp., and Wah Chang Corp. Moderate increases in demand for tantalum were mostly in the electronics field. Production of ferrocolumbium and ferrotantalum-columbium is estimated to have decreased about 50% in 1958 due to the reduced demand for stainless steel during the recession.

Prices for foreign columbite containing 65% combined pentoxides and a Cb:Ta ratio of 10:1 dropped from \$1.15-\$1.20 to \$1.05-\$1.10 per lb of contained pentoxides during the year. For material containing Cb:Ta in an 8½:1 ratio the price reduction was from \$1.00-\$1.05 to \$0.95-\$1.00. Prices for foreign tantalite ore were not regularly quoted, but depending upon tantalum pentoxide content and Ta:Cb ratio they ranged upward from about \$3.00 per lb of contained tantalum pentoxide in material containing 25% tantalum pentoxide to almost \$9.00 per lb of tantalum pentoxide in material of more than 70% grade. Domestic ore prices continued to be influenced by the price schedule of Public Law 733, 84th Congress. Most purchases under the law were at a price of \$3.40 per lb of contained pentoxides for material containing at least 50% combined pentoxides irrespective of ratio (expired Dec. 31, 1958).

Metal prices declined as a result of increased competition and more efficient production methods. Domestic columbium powder was available as low as \$30 per lb in large lots; tantalum powder for as low as \$40. Imported columbium powder in large lots was quoted as low as \$16 per lb, but was of a lower quality than the domestic material. Imported tantalum powder was about the same price or higher price than domestic material. The price quoted for ferrocolumbium declined from \$4.90 to \$3.90 per lb of contained columbium. Ferrotantalum-columbium prices were reduced from \$4.25 to \$3.40 per lb of contained columbium and tantalum.

Outlook. Industrial optimism was demonstrated by the continued construction of new production facilities. Fansteel Metallurgical Corp.'s new columbium-tantalum plant at Muskogee, Okla., reached full production, and National Research Corp. announced the opening of a new tantalum plant at Cambridge, Mass. Stauffer Chemical Co began construction of a \$300,000 plant for production of columbium and tantalum chlorides at Richmond, Calif., and U. S. Industrial Chemicals Co. announced construction of columbium-tantalum metal facilities at Ashtabula and Cincinnati, Ohio. The faith of producers in the future of the two metals was generated by the promise of columbium in nuclear engineering and high-temperature alloys, and tantalum in electronic devices and by its performance in such nuclear fields as the Los Alamos Molten Plutonium Reactor Experiment. Dr. Charles Hunt of Stauffer-Temescal Co.'s center forecast an eventual columbium mill product price of \$4 per lb at a market level of 800 to 4,000 tons per month in 1968. Other estimates are more conservative but a price of \$10 per lb or less seems to be an eventual certainty•

Boron

Peter Colefax
American Potash & Chemical Corp.

THE TONNAGE of boron products produced and sold was probably approximately the same as in 1957. (No published figures are available.) There was no evidence of any significant change in production of borates outside of the U.S. Production continued on a small scale in Turkey, Italy and South America; the total tonnage produced probably representing less than 5% of the total world production. The boron industry of Turkey was described in detail in "Special Supplement No. 53" (May 1958) of *Mineral Trade Notes*.

No important developments were re-

"Research continues on lithium applications in high-energy fuels and light weight alloys. Ceramics and grease remain the big consumers." *p 105*

Albert E. Schreck
Commodity Specialist, U.S. Bureau of Mines

"Galvanizing was the largest outlet for zinc and also gave the best account of itself for the year. A stronger market could provide incentive for increased domestic production." p 107

Charles R. Ince
Vice President, St. Joseph Lead Co.

corded with respect to operations of U. S. producers. U. S. Borax & Chemical Corp. reported that the start-up problems encountered in connection with their new refinery had been substantially solved. As far as is known, California Borate Co. was inactive during the year.

Drilling programs were active during the first few months of the year, but tapered off with the advent of hot weather in the Mohave Desert. Exploration activity slacked off considerably thereafter and there was little drilling during the fall months.

Kern County Land Co. reported that relatively large reserves of colemanite have been blocked out in a drilling campaign conducted early in the year in the area about 10 miles east of Boron, Calif. Estimated grade is approximately 14% B_2O_3 and the deposit is at a depth of about 1,000 ft. Mineral Materials Co., Sun Ray Mid-Continental Oil Co., Monolith Portland Cement Co., and Kerr-McGee Oil Industries, Inc., all carried on drilling campaigns in the Mohave Desert area, but no borate discoveries were reported.

The major portion of the borate produced was sold as various forms of sodium tetraborate and as boric acid. Elemental boron and the newer boron compounds introduced in recent years must still be considered in the development stage. Sales of elemental boron and certain borate esters, continued on a steady basis, but no major outlets were opened up. Possible applications of extremely high purity boron in the electronic field were under investigation. Several new boron compounds containing boron-carbon or boron-phosphorus linkages were made available in development quantities during the year. Sodium borohydride was offered in the form of a stabilized water solution.

The first substantial use of boron compounds for production of high energy fuels will take place in 1959. Callery Chemical Co. dedicated its new Navy-sponsored high energy fuel plant at Muskogee, Okla., late in 1958, and also announced operations at its own plant at Lawrence, Kan., for production of boron hydrides and related chemicals. Actual operation of the Navy-sponsored unit will not begin until sometime in 1959.

The plant being constructed by Olin Mathieson for the USAF is also expected to commence operations sometime this year. The two operations will probably raise borate requirements during the year to the extent that the consumption curve will resume its rising trend.

AFN, Inc. continued process development work on high energy fuels under an Air Force contract and also supplied small quantities of decaborane for development use from a privately-owned facility.

Research activity continued at a high level in the U. S. and numerous reports were published indicating increased activity in the field of boron chemicals in Europe. Stauffer Chemical Co. and Aerojet-General formed a new company for research on high energy fuels, including boron-based compounds. At year-end, U. S. Borax Research Corp. and Dow Chemical Co. announced a joint effort to develop a new process for production of boron trichloride•

Platinum Metals

J. Patrick Ryan
U.S. Bureau of Mines

Platinum-Group Statistics

(Thousands of troy ounces)

	1958 9 months	1957 9 months
Platinum-Group		
Imports	**489.1**	540.5
Domestic refined	**59.6**	69.8
Domestic consumption	**457.5**	540.9
Platinum		
Domestic sales and exports	**205.9**	268.2
Imports and domestic refined	**223.5**	282.7
Palladium		
Domestic sales and exports	**268.6**	276.5
Imports and domestic refined	**298.2**	301.3
Iridium, Osmium, Rhodium, Ruthenium		
Domestic sales and exports	**20.1**	30.0
Imports and domestic refined	**27.0**	26.2

LOWER DEMAND, sharply reduced world production and declining prices were features of the industry in 1958. Industrial consumption and imports of platinum metals declined for the second successive year in 1958, and prices of platinum and palladium reached the lowest level in over 10 years.

Canada and South Africa continued to supply the bulk of domestic requirements of platinum metals; however, substantial amounts of platinum and palladium of Soviet origin also were imported into the U.S. during the year. Less than 15% of the nation's industrial requirements of platinum metals, which comprised nearly two-thirds of the world's output, came from domestic sources consisting of placer deposits in Alaska, by-product platinum metals from copper and gold refining, and metals recovered from secondary sources.

World output of platinum metals in 1958 is estimated to have dropped about 30% below the 1957 record level to approximately 825,000 troy oz, as major producing companies curtailed operations in line with reduced demand. World output in troy ounces was distributed approximately as follows: Union of South Africa, 350,000; Canada, 310,000; Soviet Union, 125,000; Colombia, 23,000; U.S., 17,000.

A sharp reduction in the demand for platinum catalyst from the domestic petroleum refining industry, the largest consumer of platinum, was the chief factor in the drop in plat-

inum sales in 1958, although sales for electrical uses also declined but sales for other uses were moderately higher during the year. Consumption of palladium, used chiefly for electrical contacts in regulating equipment, was lower; palladium sales for jewelry and decorative, and for dental and medical uses increased during the year but failed to affect the drop in electrical sales.

Platinum sales to domestic consumers in the first 9 months of 1958 were 178,000 oz of which about 62% was for chemical uses (including petroleum refining); 18% electrical; 4% dental and medical; 13% jewelry and decorative; and 3% miscellaneous. From a high range at the beginning of the year of $76-$80 a troy oz, the price of platinum dropped steadily to a range of $51-$55 at the end of the year, the lowest since 1947.

Palladium sales to domestic industries in the first 9 months were $260,400 oz, most of which (64%) went to electrical consumers; 33% for chemical uses; 8% dental and medical and 5% jewelry and decorative. The price of palladium declined from a high range of $21-$22 early in January to a low of $15-$17 in July remaining unchanged to year-end.

Consumption of the minor platinum metals, iridium, osmium, rhodium, and ruthenium as indicated by sales was 19,200 oz for the first 9 months. The price of iridium was reduced in January from $100-$110 to $70-$80 an oz and remained unchanged thereafter. The price of osmium also was reduced in January from $80-$100 to $70-$90 and was unchanged thereafter. Price quotations per troy ounce for rhodium and ruthenium continued unchanged during the year at $118-$125 and $45-$55, respectively.

The short-term outlook for platinum is for ample supplies of metal with not much change in demand; prices may be expected to trend somewhat lower before leveling off. In the long-term view, increased use of platinum catalyst reforming in petroleum refining, particularly in foreign countries, may be forecast. Research and development being carried out by the platinum-metals industry may lead to expansion of existing applications and the development of new ones. A newly developed platinum alloy having exceptional magnetic properties is expected to find many applications in instruments and electronics, and improved high-resistance alloys have been developed for use in potentiometers and transducers for industrial equipment and in guided missiles. A new process of platinum plating for high-temperature application was made available during the year and may find a considerable range of industrial use, including connectors and circuitry for missile and rocket manufacturing•

"Quebec asbestos producers met strong competition in 1958, and it will continue to strengthen. Capacity has expanded greatly." p 145

Walter A. Rukeyser
Consulting Engineer, Montreal, P.Q.

Mercury

John R. O'Connell, Jr.
Assistant Editor, Markets

OPINIONS of the 1959 mercury market vary according to the position (in the market) of the observer. Sellers who are short see the market slumping quickly. Those who are long see present prices holding with a possible move up. Few if any forecasters will venture beyond the first half.

The view of the neutral, uncluttered by a position or prejudice, is nevertheless clouded by uncertainty. Immediate answers to half a dozen or so questions would clear the way for a bright or bleak 1959 in mercury. Among them are: Will the U.S. Government extend its buying policy, and if so, for how long? Will barter deals extensive enough to maintain a firm market be feasible under present conditions? Will demand in the U.S. pick up? How long will European sellers be able to remain out of a falling market?

U.S. consumption of mercury has dropped each year since the 1955 bottom, and along with it the price has dropped from $290 to $229 per flask on a yearly average price basis. During this period (1954-58) the domestic industry benefited from the U.S. Government's buying support program set at $225. It was not until mid-1957 and through 1958 that the industry turned to GSA for help, but the floor price stood firmly below the market nonetheless. Buying support ended on Dec. 31, 1958.

If, as many are hopefully predicting, GSA extends its buying in 1959, prices of about $235 to $240 may be safely predicted over the buying period, figuring on a reasonable upswing in demand. As of this writing all hopes are based on rumor, and for purposes of conjecture it is wiser to consider 1959 minus Government aid.

A second major focus in 1959 will be the position of Spanish and Italian sellers. As 1958 ended, both factors had withdrawn from the market, as they are periodically wont to do, indicating a lack of willingness to sell at U.S. levels of about $218 ($196 realized). Though their positions may vary, it is assumed a realized price of $200 is the cutoff point.

. . . *"Manganese was dominated by the barter programs in 1958. Inventories at year-end amounted to 2-million tons, which may be enough for all of 1959."* p 154

Lemuel V. Reese
New York, N. Y.

In the past 10 years the difference in U.S. mine output and consumption has varied from about 10,000 to 30,000 flasks or more annually. The difference is made up by imports — mainly from Spain and Italy with Mexico and Yugoslavia next in importance. In 1957, in the face of falling demand and prices, U.S. producers chose not to cut back. As a result continued heavy output helped push the U.S. price down to the support level. Heavy sales to GSA were largely responsible for the sharp drop in duty-free imports, previously purchased for the account of Government agencies —the AEC in particular.

With consumption down and mine production at its highest level since 1953, the gap has narrowed, possibly to no more than 5,000 flasks depending on final 1958 statistics. Mexico, geared high for the U.S. buying program, stands ready to take up the slack. It would seem that the position of the European seller— though capable of creating a tight market—is less crucial in the mildly-improved, non-war year forecast for 1959. His position gains importance in a falling market. As high-cost U.S. and Mexican producers are squeezed out, his share of the consuming market increases.

Spanish sellers, and to a lesser extent Italian, tied to their individual governments, are in a position to sit out the market a great deal longer than can the independent U.S. producer. Despite optimism on the part of bulls, opinion is that European interests can wait just so long—particularly the Italians, who have built up sizeable stocks under the burden of the about-to-be discarded £18½ ($52) export tax.

The ability of the domestic producer to sit back and stock metal is limited to short periods. The suggested shortage of spot metal early in 1959, as domestic mines prepared shipments and European sellers withdrew, was easily counteracted by Mexican shipments and metal from small domestic mines. Demand had yet to develop.

Strong demand in 1955 and 1956 was sparked by construction of numerous new chlorine and caustic soda plants, each requiring about 3,000 or more flasks. Many existing installments were enlarged. At present these industries appear over produced and it seems unlikely 1959 will turn up many new starts. This metal does not have to be replaced.

Mercury Statistics*

	1958	1957
Mine production	37,000	34,625
Secondary	5,500	5,800
Total	42,500	40,425
Stocks end:		
Producers	1,000	3,749
Consumers, dealers	11,000	17,000
Total	12,000	20,749
Imports (Industry & Gov't):		
Dutiable	18,000	26,876
Free	12,000	15,129
Total	30,000	42,005
Exports	550	1,919
Consumption	45,000	52,889
To GSA (b)	13,000	(c)9,428
Price (a)	$229.057	$246.978

(a) Final (b) Domestic only (c) 1954-57

* U. S. Bureau of Mines figures for 1957 and estimates based on USBM third quarter 1958 data.

Prospects for the first half of 1959 look poor. Without Government support pressure on the market is downward — strong enough to push aside periodic hold-outs by either domestic or European interests. As one observer put it, "If five sellers hold out for better prices in a weak market and a buyer comes in for a good order, 40 others will offer him a bargain." Simply, there will be more metal than needed in 1959, developing weakness.

The U.S. Tarriff Commission reported average U.S. production costs per flask in 1957 as $174. The average realized price was $234. In 1956 the average costs were $214 with an average realized price of $248. Since producers keep costs down in a falling market by exploiting higher grade ores, cost per flask in 1958 may be estimated at between $165-70 with the realized price probably around $220. These costs are average and probably rock bottom for the industry as it presently stands. Some small mines and the difficult Alaskan operation run closer to $200. Spanish costs have been estimated at about $110, including sizeable subsidies to church and state. Estimated Italian costs run higher, about $130, exclusive of the about-to-be discarded export tax of $52.

Conceivably prices here could dip below $200 in the first half, forcing out a number of high-cost producers. Pessimistic predictions of much lower levels have been voiced. At $200, realization on imported metal would be slightly under $180.

One foreign seller expressed belief that barter (restored in 1958) would take up where Government buying left off. Instead of taking U. S. (and Mexican) metal, the Government will concentrate on trading surplus agricultural commodities for foreign metal. One such deal was completed in 1958. An announcement was made Sept. 11 that Spain had bartered 16,000 flasks to the U. S. for 18,800 bales of cotton. The price of the mercury was $202 per flask, f.o.b. Spain (equivalent $224 c.i.f. U. S.). On the date of the announcement the New York price was $239.

In the case of this particular deal, it is unlikely that the U. S. Government would have been willing to pay more than the effective support price of $225. Willingness of the Spanish to deal at well under the U. S. market price appears wise. The price here dropped shortly thereafter and has shown little sign of recovery. Certainly the removal of 16,000 flasks from the market didn't hurt.

Nearly all agree extensive barter could firm the market, but further deals may be difficult. The Commodity Credit Corporation would probably want to deal at current U. S. prices. For example, $215 less tariff, freight and insurance leaves $193 as a point of departure for negotiation. With mercury stockpile requirements long ago fulfilled, and AEC and other Government agency needs taken care of by the recent buying program, there is no urgency for CCC to buy. They would be in a position to demand a price of $10 to $15 below the $193 level. It is unlikely European sellers would be willing to accept such terms other than to rid themselves of unwieldly surpluses. The likelihood of more barter is fairly certain. Whether

. . . *"A sharp drop in selenium production aided a return to a balanced supply-demand pattern. International Nickel Co. announced a new process."* *p 104*

Frank L. Fisher
Commodity Specialist, U.S. Bureau of Mines

it will be enough to buoy the market is doubtful. The extent of European stocks is unknown. It is possible limited barter might hardly be noticed. It has been called the market's only hope, if GSA buying is not extended and demand fails to revive.

Ten thousand flasks of the 16,000 bartered arrived here in 1958. The remainder will be shipped in 1959. There have been numerous rumors of other barter deals in recent months.

Without Government buying or consistent barter, the market must fall, driving out high-cost U. S. producers. Larger U. S. mines will be left to compete with each other and imports. Naturally demand is the key. The year ended was a poor one even with Government assistance. If demand shows no improvement and there is no aid from the Government, the entire industry must be prepared to gear down sharply.

Mercury began 1958 at $223, reached a high of $240 by Sept. 3 and dipped to a low of $218 in December, at which point it closed the year.

"Beryllium consumption hit a new high in 1958; production was the lowest since 1955. Demand for beryllium products is expected to increase." p 102

Donald E. Eilertsen
Commodity Specialist, U.S. Bureau of Mines

Extension of the 1957 buying program through 1958 pushed metal up in March, but by April flask specification problems and failing demand eased the price to $228. Good demand in Europe, along with steady selling to the Government and Teamster union troubles on the West Coast tightened the market—prices moved to $240. London was £79 ($221). Consumption in the fourth quarter slumped as buyers awaited word from Washington. Demand in Europe subsided. The combination drove the market to $218•

Germanium

Frank L. Fisher
U.S. Bureau of Mines

Germanium Prices

(Cents per gram)

Lot quantity	Grade	Delivered	f.o.b. shipping point
1,000 gram	1st red.	40	43½
1,000 gram	Intrinsic	44¼	48½
10,000 gram	1st red.	38	37
10,000 gram	Intrinsic	40.2	39

THE TENTH ANNIVERSARY of the germanium transistor was marked with appropriate ceremony during 1958. This revolutionary electronic device was first announced by Bell Telephone Laboratories on June 30, 1948. Millions of germanium transistors have been produced during this past decade, and the tiny electronic device not only ushered in a new concept of solid-state physics but also radically influenced design of electrical and electronic devices.

Estimated U.S. consumption is 70,000 lb of germanium in the metal form and as germanium dioxide used in the manufacture of semiconductor devices during 1958. This is comparable to the 1957 production and is an estimate based on 75% of the Free-World supply. An estimated 45-million germanium semiconductor devices were manufactured during the year, valued at nearly $27-million. Production of germanium diodes, transistors, and rectifiers was at a rate comparable to 1957 although inventory stocks of the devices increased sharply.

The price in 1,000-gram lots of both first-reduction and intrinsic grades was stable during 1958. The 10,000 gram lot price decreased twice during the year. The year-end price quotations which prevailed since July 24 are as shown in the table.

Price of domestic germanium dioxide decreased during 1958 from a high of 27.5c a gram at the beginning to 24c a gram in June. Quotations on foreign dioxide have been reported as low as 17.5c a gram.

Production of germanium was not reflected in the curtailment of zinc production in 1958. The three domestic germanium producers in 1958 were American Zinc Co. of Illinois at Fairmont City, Ill.; Eagle-Picher Co. at Henryetta, Okla.; and Sylvania Electric Products, Inc., Towanda, Pa. Major foreign producers of germanium continued to be the Tsumeb mine in South West Africa and the Prince Leopold mine in the Belgian Congo. Concentrates from these two operations are processed at Olen, Belgium, by Societe Generale de Hoboken.

Germanium transistors found wide application during the year in the fields of packaged and miniaturized electronic components. These are specifically desirable for computers, telemetering, and instrumentation systems. Further advances in germanium transistors were made during the year in astronautics; the devices were labeled the key to missile guidance. New design and improved quality have greatly increased the range of application of germanium devices. This was particularly noted during the year in operation specifications for higher power and frequency, and the increased use in rapid switching. It was announced in 1958 that germanium and silicon transistors could

"Though year-end phosphate estimates show an increase in marketable domestic production, competition in the U. S. and abroad forced producers to put more emphasis on cost-cutting." p 144

Finn B. Domaas
Assistant Editor, *E&MJ*

"A cadmium sulphide electric generator has been prefected at Wright Air Development Center to the point where it produces plus 8 volts of electricity when impinged by sunlight." p 106

Arnold M. Lansche
Commodity Specialist, U.S. Bureau of Mines

perform 70% of the applications of vacuum tubes. Germanium transistorized radios and other miniature electronic devices were available to the civilian consumer during the year in a wide range of models at more competitive prices than previous.

Several new uses for the element were announced, although the quantity of germanium consumed in 1958 was for semiconductor devices. The use of germanium as a catalyst indicated it was one of the best catalytic materials, especially after being subjected to an electric charge. Germanium catalysts are ideal for low-temperature reactions. A new resistance thermometer with a germanium bridge was introduced in 1958 which showed high stability at temperatures near absolute zero. Research was continued in 1958 on the feasibility of commercially extracting germanium from coal and other hydrocarbons without announced success•

Silicon

H. Austin Tucker
U.S. Bureau of Mines

HIGH-PURITY silicon production and consumption continued to increase in 1958 as in 1957. Additionally, production capacity was increased approximately threefold. An estimated $13-million was paid for about 41,000 lb of high-purity silicon, exclusive of solar-cell grade silicon, consumed for the production of semiconductor devices. Newer and more efficient processes for making high-purity silicon came into use during the year resulting in less waste, and in price reductions. Research was pursued at an accelerated pace by both producers and consumers.

The highlight of 1958 was the large increase in the productive capacity of high-purity silicon which is indicative of the rapidly growing demand for its use in semiconductor devices. E. I. duPont de Nemours & Co., Inc., began operations in July at their new $5-million plant at Brevard, N.C. that is designed to produce 50,000 lb of high-purity silicon a year and 20,000 lb of solar grade silicon. Merck & Co. got into full scale production at their new $5-million plant at Danville, Pa. in August. This plant reputedly has a productive capacity in excess of 25,000 lb per year. International Metalloids, Inc., controlled by W. R. Grace & Co., began production at their new 20,000-lb per-year plant at Toa Alta, Puerto Rico. The product is marketed by Grace Electronic Chemicals, Inc., Baltimore, a newly formed subsidiary of W. R. Grace & Co. Sylvania Electric Products, Inc., Texas Instruments, Inc., and Eagle-Picher Co. are the remaining commercial producers of high-purity silicon. Mallinckrodt Chemical Works and Monsanto Chemical Co. are preparing to enter into production.

The production picture is cloudy since competition is keen for the rapidly expanding market. Although actual production data are not available, domestic output of high-purity silicon in 1958 is estimated at 50,000 lb compared with 30,000 lb in 1957.

Consumption of high-purity silicon in 1958 is estimated at 41,000 lb valued at $13-million compared with 25,000 lb in 1957. From this an estimated 6.5-million transistors, and 22-million diodes and rectifiers were made. Silicon rectifiers are continually being improved for a greater variety of uses. Their small size, ultra long life, and high efficiency together with competitive pricing have stimulated their demand. They are used in battery chargers, dc motors, television and radio sets. Transistors and diodes are being used in electronic computers, and in aircraft, missiles and satellites. Silicon semiconductor devices are preferred over those made from germanium for applications where the temperature is in the 150 to 350 deg F range.

Technology: In the race for improved methods of producing silicon of the highest purity, some domestic firms have adopted foreign technological methods. Du Pont has a licensing agreement with International Telephone & Telegraph Corp. to use the

High Purity Silicon Statistics

Producer	Plant capacity (pounds)	Plant location and year started	Price per lb	Boron level (parts per billion)	Resistivity (ohm-cm) "R"	Resistivity (ohm-cm) "N"
E. I. duPont de Nemours & Co., Newport, Del.	50,000	Newport 1951	(4)320–355	3	100	25
		Brevard, N. C. 1958	220–245	6	50	15
			130–155	11	25	5
Grace Electronic Chemicals, Baltimore	20,000	Toa Alta, P. R. 1958	(4)320–355	3	100	25
			220–245	6	50	15
Merck Chemical Co. Rahway, N. J.	25,000	Danville, Pa. 1958	(4)330–750	1 per 6 billion	1000 to 5000	1000 to 5000
Sylvania Electric Prod. Inc., Towanda, Pa.		Towanda 1956	359	(2)	100	40
			250	(2)	40	15
Texas Instruments, Inc., Dallas, Tex.	(1)70,000	Dallas 1957	330	(3)1	100	—
			220	(3)3	40	15
			130	(3)5	25	5
Eagle-Picher Co., Cincinnati, Ohio		Miami, Okla. 1957	360	2	100	40
			250	6	40	15
Total	165,000					

(1) Includes capacity for captive production. Value is estimated.
(2) Not yet specified.
(3) Total impurities: boron level below 1 part per billion.
(4) Depending upon physical shape.

method developed by their British subsidiary. The IT&T method is reported to be a reduction of silane claimed to produce a grade of silicon equal in purity to any on the market. W. R. Grace & Co. through its subsidiary, International Metalloids, Inc., is joined with Pechiney of France using the latter's process for purifying silicon. Merck & Co. has an agreement with the two West German firms, Siemens & Halske and Siemens-Schuckertwerke to use their raw material and much of their manufacturing techniques, but domestic equipment has been used in the Danville, Pa. plant.

The accompanying table summarizes the salient facts about the makers of high-purity silicon and the price and purity of their products. The price varies with the physical shape of the product as well as the purity. Prices on the left-hand side of the "Price per pound" column are those in the needle or granule form, whereas the right-hand side is the rod form. Du Pont and Grace have a densified form priced within the range shown.

The outlook for high-purity silicon in 1959 is for doubling of the 1958 consumption. Production capacity is built and already in operation to provide this predicted expansion•

Zirconium

F. W. Wessel
U.S. Bureau of Mines

SUPPLY OF METAL overtook the demand during 1958. Military requirements for nuclear reactors increased, while demand for civilian purposes decreased sharply. The Shippingport (Pa.) power reactor began operations, and construction of the Dresden reactor in Illinois continued during the year. The keel of the N. S. "Savannah," first nuclear propelled merchant ship, was laid in June, and construction of the *USS Longbeach*, a guided-missile cruiser, and the *USS Enterprise*, an aircraft carrier, both atom-powered ships, continued. Sponge producers approached full capacity operation. The sale of zircon concentrate, at a low ebb during most of the year, showed signs of greater activity in the last quarter,

Production of reactor-grade metal continued to increase; preliminary estimates showed 1958 output to be more than double that of 1957. During the year, Carborundum Metals Co. made tetrachloride at Parkersburg, W. Va., for both its plants. The Parkersburg plant ended the year at about full capacity; production at the Akron, N. Y., plant was suspended during the last quarter. Wah Chang Corp. returned its leased facilities in Albany, Ore., to GSA, but continued to produce in its own plant in that city at a high rate until the last quarter, when production was curtailed. Mallory-Sharon Metals Corp.'s Ashtabula plant ended the year at a production rate sufficient to enable fulfillment of the AEC contract requirements. Production at the Columbia-National Corp.'s Pensacola plant showed substantial increase compared with 1957. The general tendency throughout the year was toward integration of production facilities; at the year's end all four producers were chlorinating raw zircon and melting some ingot.

Zirconium Statistics

(Short tons)

	1958 estimated	1957
Domestic zircon production	26,100	56,802[1]
General imports	17,300	41,692
Average price	$45	$53
Domestic zircon production	1,500	N.A.
General imports	150	47
Year-end price, reactor-grade, lb	$6	$7.50

[1]Florida only.

Mallory-Sharon Metals Corp. was formed during the year. It is owned by National Distillers and Chemical Co., P. R. Mallory Co., and Sharon Steel Corp.; assets include the zirconium production plant formerly owned by U. S. Industrial Chemical Co. and the melting plant formerly owned by Reactive Metals, Inc., both at Ashtabula, Ohio, and fabrication facilities and an electrolytic plant in Niles, Ohio. The company also purchased the nearby Stauffer Chemical Co. chlorinating plant.

Kennecott Titanium Development Corp. at Bedford, Ohio, is continuing experimental work on electrowinning of zirconium from a fused-salt bath. The Titanium Alloy Metals Division of National Lead Co. has developed a method for producing Zircaloy directly in a ram-type reactor.

Receipts of Japanese zirconium under barter agreement were terminated late in the year. The contract expired.

Allegheny Ludlum Steel Corp., Carborundum Metals Co., Firth Sterling, Inc., Harvey Aluminum, Inc., Mallory-Sharon Metals Corp., Oregon Metallurgical Corp., and Westinghouse Electric Co. have a total melting capacity of 5,930,000 lb annually; much of this may be titanium melting capacity, which is also available for zirconium.

Johnson & Funk Titanium Corp., producers of zirconium rod and wire, was purchased during the year by Mallory-Sharon Metals Corp.

The General Atomics Division of General Dynamics Corp. exhibited, at the 2nd International Atomic Energy Conference at Geneva, a research reactor in which self-controlled safety was featured. This is accomplished by the use of fuel-moderator element, consisting of solid, homogeneous uranium and zirconium hydrides (about 78% Zr). Possibly as a reflection of this development Metal Hydrides, Inc., placed on the market a new grade of high-purity zirconium hydride.

In September, Mallory-Sharon announced a reduction in the price of reactor-grade sponge from $7 to $6 per pound in lots of over 500 lb.

The price of hafnium sponge, nominally $25 per pound remained unchanged during the year. During October 1958, the AEC advertised for bids on the centralized reduction of 65,000 lb of hafnium oxide to high-purity metal, deliveries to begin early in 1959.

"Columbium metal production more than doubled over 1957, with most of the metal destined for nuclear engineering applications. New plants were announced." p 94

William R. Barton
Commodity Specialist, U.S. Bureau of Mines

Zirconium (*Continued*)

The price of domestic zircon concentrate declined from $50 to $55 per short ton, f.o.b. mines, at the beginning of the year to $41 to $42 at the year's end; demand was weak throughout the year but closed a little stronger. Imported zircon declined from $50 to $51 per long ton, c.i.f. Atlantic Coast ports, to $46 to $48; Australian shippers were aided by a reduction in freight cost of $6 per long ton, effective about midyear.

In February, Du Pont took over operation of its mines and mills in Florida; Humphrey's Gold Corp. continued to operate properties east of Jacksonville. Both companies curtailed production. Early in the year the South Carolina operation of Marine Minerals, Inc., suspended work. At the year's close, three new deposits in Florida were being prepared for operation.

A large body of titanium-zirconium-bearing sand has been discovered in New Jersey by the State Geological Survey and the American Smelting & Refining Co. Several companies were examining placer deposits in Idaho for dredging, but no zircon production is expected in the near future.

Orefraction, Inc. produced ground and sized zircon from its new facility at Andrews, S. C.

Preparations for black sand mining in the Nile delta and on the coast of the Union of South Africa near Durban are proceeding, and it seems likely that additional African zircon will be available in 1960, although whether this will compete in American markets is not certain.

Outlook for zirconium metal indicates that demand for military use will increase gradually, but that a civilian market of any size is several years in the future. Widespread acceptance of zirconium-hydride-moderated reactors might be a factor in increased demand. Present productive capacity seems adequate. Competition from stainless steel may increase, however, if the trend toward nuclear reactors operating at higher temperatures and with more highly enriched fuels continues.

Hafnium will find almost its sole use in reactor control rods, although two less-expensive alloys have been developed and are being tested. Use of hafnium in refractories is a long-term possibility.

The supply of zircon seems assured. Demand should increase moderately as refractory, ceramic, and chemical requirements remain firm and foundry use increases. Requirements of zircon for metal and ferroalloy production should not be less than the 14-million lb consumed in 1958•

Thorium

James Paone
U.S. Bureau of Mines

USE in magnesium-thorium alloys containing about 3% thorium accounted for the largest single nonenergy use during the year. Progress continued in the design of thermal breeder reactors employing thorium but the question of widespread use for energy purposes remained unanswered in 1958.

Free World production of monazite during the year was on the order of 12,000 to 14,000 tons containing 5 to 6% ThO_2, the highest production rate yet experienced in the industry. The U. S. was by far the largest consumer. Principal domestic thorium production from placer deposits was from South Carolina and Idaho and from thorite-type deposits in Colorado. The most important foreign source of monazite continued to be the Union of South Africa massive monazite deposit. Embargoes on the export of thorium ores imposed by India in 1945 and by Brazil in 1951 remained in effect.

Thorium producers during the year were Humphreys Gold Corp., Jacksonville, Fla., and Porter Brothers Corp., Boise, Idaho. Northwest Prospecting & Development Co., of Spokane, Wash., milled thorium concentrate in Montana from thorite mined on Hall Mountain, north of Bonners Ferry, Idaho, for shipment to Heavy Minerals Co., Chattanooga, Tenn. Wah Chang Corp.'s mill at Boulder, Colo., shipped concentrates from thorite deposits in Colorado to Davison Chemical Co., Erwin, Tenn. Significant activities in exploration and development of thorium deposits in the Lemhi pass area of Lemhi County, Idaho, were noted, chiefly by Nuclear Fuels & Rare Metals Corp. Sawyer Petroleum Co., and Agency Creek & Rare Metals Corp.

Refined products were produced principally by Lindsay Chemical Division, American Potash & Chemical Corp., formerly Lindsay Chemical Co., West Chicago, Ill., W. R. Grace & Co., Davison Chemical Division, Erwin, Tenn., and Heavy Minerals Co., Chattanooga, Tenn. Mallinckrodt Chemical Works, St. Louis, Mo., continued to recover some thorium from Idaho euxenite concentrates processed primarily for columbium and uranium. Nuclear Materials & Equipment Corp., Apollo, Pa., produced

Thorium Prices

Metal (per gram)	Less than 200 grams	More than 200 grams
Powder & sintered pellets	$0.45	$0.35
Unsintered bars	.50	.40
Sintered bars	.65	.50
Sheet, 0.005 in. or more	.75	.60
Sheet, 0.002 in. to 0.0049 in.	.85	.85

Metal (per pound)	Powder or pellets	Thorium ingot
Less than 10 lb	$50.00	$54.00
10 to 100 lb	41.00	45.00
100 to 500 lb	34.00	38.00
500 to 2000 lb	26.00	30.00
Over 2000 lb	20.00	24.00

Compound (100-lb lots)	Percent ThO_2	Price per lb
Carbonate	[1]0-85	$7.25-8.[1]0
Chloride	50	7.00
Fluoride	80	6.50
Nitrate (mantle grade)	46	3.00
Oxide	97-99	5.75-8.50

[1]Variable depending on rare-earth content.

"Domestic uranium producers now have guaranteed market through 1966. Nuclear power may be economic outside the North American Continent by the mid-1960's." p 118

James W. Franklin
Associate Editor, E&MJ

thorium alloys and M&C Nuclear, Inc., Attleboro, Mass., fabricated thorium in various forms for nuclear experiments. Westinghouse Electric Corp., Lamp Division, Bloomfield, N. J., fabricated thorium sheet and other products for use in electronic and related equipment. USBM continued research on methods and techniques of producing high-purity thorium.

A new firm, Rio Tinto Dow, Ltd., was formed by the Rio Tinto Mining Co. of Canada and Dow Chemical of Canada, Ltd., to conduct research into recovery of thorium and rare earths leaving Rio Tinto's uranium mills in the Blind River area in Ontario, Canada. Construction began on a thorium recovery plant adjacent to the Quirke Lake uranium mill near Elliot Lake, Ont., and operation was expected by early 1959.

Current prices for 10% thorium concentrate averaged $1.75 per lb of ThO_2 content in thorite ores. Prices for thorium contained in domestic monazite have remained relatively stable in recent years and varied from $25 to $40 a percent-ton of contained ThO_2.

Commercial-grade thorium metal (chief impurities-calcium, about 0.05%) was available in small lots during 1958 at the prices and in the forms shown in the table.

Thorium metal as powder or sintered pellets was being offered for sale by Davison Chemical Co. at $15 per lb metal and by Dominion Magnesium at $12.50 per lb metal plus cost of freight and import duty. Other prices are shown in the table.

Reactor-grade thorium metal produced at AEC Feed Materials Production Center, Fernald, Ohio, was offered by the Commission at a price of $43.00 per kilogram, or $19.55 per lb as compared with $40 per kilo for normal uranium metal. The AEC maintained a "buy-back" price for uranium-233 nitrate at $15.00 per gram of uranium for the material produced abroad through the use of the fuel obtained from the Commission under agreements for corporation.

Desirable characteristics of light weight, stiffness and resistance to heat of magnesium-thorium alloys attributed to the increasing interest in applications of the material in missile construction. Approval by the Defense Department of the Bomarc interceptor missile marked the first large-scale use of magnesium-thorium alloys. The missile, built by Boeing Airplane Co., weighs 7,500 lb and makes extensive use of magnesium-thorium sheet, extrusions and castings. Dow Chemical Co., Midland, Mich., principal manufacturer of the alloys, indicated that in finished form the magnesium-thorium alloys are the least expensive of all airplane materials capable of performing at speeds of about 1500 mph. During the year, Davison Chemical Division, W. R. Grace & Co., Erwin, Tenn., offered, on a commercial basis, thorium hardener, an agent for introducing thorium into magnesium alloys. Consumption of thorium in magnesium-thorium alloys was expected to exceed 1957 alloy consumption by 25%.

Gas mantle manufacture continued at about the same rate of thorium consumption set in the previous year. Minor quantities of thorium also were consumed in refractory materials, electronic tubes and some lighting devices.

Thorium's potential in atomic power became more apparent during the year. Several papers presented at the 1958 Geneva Conference described thorium fuel cycles; one paper pointed out that thorium converters could achieve a fuel cost competitive with that of conventional fuel in the U.S. provided that a fuel exposure of 20,000 Mwd/ton of thorium and a conversion ratio better than 0.8 could be attained. A new proposal was made to the AEC by a group of utility companies, headed by Philadelphia Electric Co., to construct a 30,000 electrical kilowatt gas-cooled nuclear-reactor power plant. The reactor would use thorium and enriched uranium as fuel. In addition, at least six experimental and full-scale reactors were either experimenting with, using, or planning to use thorium as a fuel. The Th-U^{233} cycle has attractive nuclear and metallurgical properties but fabrication costs per fuel element seem to entail higher costs than do other nuclear-fuel cycles.

Outlook for thorium in magnesium-thorium alloys is bright; being lighter and stronger than aluminum and stronger than magnesium, magnesium-thorium alloys will find increased application in missiles and rockets. Demand for thorium nitrate for gas mantles appears to be promising.

Interest in the use of Th-U^{233} cycle will continue. Several firms engaged in research on thorium-uranium cycles feel that the system is most hopeful for breeding in thermal reactors, inasmuch as it offers increased fuel element and core life, better neutron economy, and greater power levels•

"Increased use of the platinum-group metals as catalysts in petroleum reforming may be forecast. The short term outlook is one of ample supply." p 95

J. Patrick Ryan
Commodity Specialist, U.S. Bureau of Mines

Beryllium

Donald E. Eilertsen
U.S. Bureau of Mines

Beryl Statistics

(Short tons)

	1958 estimated	1957
World production	9,500	11,300
U. S. mine shipments	520	521
U. S. imports	5,500	7,290
Total new supply	6,020	7,811
U. S. consumption	6,200	4,309
Average U. S. price per unit BeO (11% BeO)	$48	$48
Average foreign price per unit BeO (10% BeO)	$34	$35

A NEW HIGH was established for U.S. beryl consumption in 1958. An estimated 6,200 short tons of beryl was processed into products for industry and Government. Much of the increase in beryl consumption over 1957 was the result of greater production of beryllium metal; however, beryllium-copper master alloy continued to be the principal product made. Substantial quantities of beryl were consumed in producing beryllium ingot by the new Beryllium Corp. plant at Hazelton, Pa., and by Brush Beryllium Co.'s new plant at Elmore, Ohio,

for the AEC. Each of these firms has a contract for annual delivery of 37,500 lb of reactor-grade beryllium to the AEC. These contracts supersede prior contracts for annual delivery of 100-000 lb of beryllium metal.

Approximately 520 short tons of beryl averaging about $529 per ton were shipped by almost 200 operations in the U.S. in 1958, and most of the ore was sold to the Government for premium prices as incentive for production of beryl. There was some activity on milling and processing beryl by firms in Colorado.

Imports of beryl, mostly from Argentina, Belgian Congo, Brazil, and India were expected to total 5,500 tons averaging $339 per ton. Imports have not been so small in quantity since 1951.

Beryllium sheet became commercially available in sizes up to 30x60 in. This development is coupled with advances made in welding and joining, and sheet and plate-forming techniques. Advances have also been made in forging and extrusion of beryllium and improving the finish.

Research on beryllium by various Government agencies and industry was aimed at producing suitable metal for use as structure material in aircraft and space vehicles. During the last half of 1958, the Bureau of Mines stepped up its research on beryllium. The Bureau's work on evaluating ore deposits, and research on beneficiation and processing beryl, and purification of beryllium were increased. A quick reliable field test for detecting small quantities of beryllium in minerals and rocks was sought for use by prospectors.

Outlook. Through October 2,115 tons of hand-sorted beryl cobbed free of waste was purchased by GSA for the Government on its purchase program for domestically produced beryl. This program terminates June 30, 1962, or when 4,500 short tons of beryl have been delivered, whichever occurs first. Exploration for beryl under DMEA continued until June 30, 1958. The successor agency, Office of Minerals Exploration, will also continue to encourage exploration for new sources of beryl. The outlook in 1959 is for increased demand for beryl products•

Antimony

H. M. Callaway
U.S. Bureau of Mines

ANTIMONY was in the doldrums in 1958. Consumption lagged behind 1957, reflecting a lower level of general industrial activity, and primary and secondary smelters curtailed output. Import offerings were accepted in restricted quantities, thereby maintaining a balance between supply and demand. Shipments to Government account were considerably less than in past recent years.

According to preliminary figures, consumption of primary antimony during the year fell 16% to a total 10,000 tons. Use in battery grids, antifriction bearings, cable sheathings, type metal, and other metallic products accounted for 56% of the total consumption; and non-metallic uses in flameproofing chemicals, paints, ceramics, glass, and pyrotechnics represents 44% of consumed antimony. Metal use declined in relation to the business cycle, generally, and to the automobile industry, specifically. A 28% decreased use in non-metal products apparently is attributable to a combination of two factors; a business slowdown and a displaced use of antimony oxide in several industrial processes.

Antimony Statistics

(Short tons)

	1958 estimated	1957
Domestic mine production	668	710
General imports	8,700	15,200
Primary smelter production	9,600	11,500
Consumption of primary antimony	10,000	11,900
Price, cents per lb	29.00	33.00

Domestic smelters produced 9,600 tons of primary antimony in 1958—approximately 2,000 tons less than in 1957. However, the decrease was almost wholly confined to metal. Output of oxide and byproduct antimony in antimonial lead continued at the pace set in 1957. Smelters were fed chiefly by imported ores. Sunshine Mining Co., the only domestic mine producer, reported an output of 668 tons of metal redeemed from tetrahedrite mined near Kellogg, Idaho. There was no stibnite ore mined in the U.S. in 1958. In addition to antimony ores, primary smelters derived antimony from processing lead bullion and other intermediate products.

Output of antimonial alloys from scrap metal dropped from 22,000 tons in 1957 to 19,000 tons in 1958, responding quickly to lower demand.

Imports totaled 8,700 tons—a drop over 40% from the previous year. Metal, oxide, and concentrates shared proportionally in the decline. In quantitative order Bolivia, Union of South Africa, and Mexico contributed the ore and concentrates. Yugoslavia and United Kingdom were the larger contributors of metal, and U.K. furnished most of the oxide imports. Considerable sulphide also was imported from the U.K. U.S. exports of antimony were in insignificant quantities.

The price of RMM brand 99.5% antimony, f.o.b., Laredo was reduced Feb. 14 from 33.00 to 29.00c per lb. New York equivalent was then quoted at 31.09c. Later in the year, increased freight rates upped the New York price to 31.30c. Foreign metal was quoted over a range from 23 to 25c, duty paid delivery in New York, the exact price being determined by grade and origin.

The restricted intake of imports and curtailed output of smelter products maintained the slowed pace of consumption, so that stocks at year's end in warehouses of consumers, dealers, and smelters was approximately the same as those of Jan. 1.

It seems likely that antimony will continue to be the most adequate and economic material to satisfy present industrial requirements•

"The first substantial use of boron compounds for production of high energy fuels will take place in 1959. Exploration drilling tapered off in mid-year 1958." p 94

Peter Colefax
President, American Potash & Chemical Corp.

Selenium

Frank L. Fisher
U.S. Bureau of Mines

THE U.S. SELENIUM INDUSTRY showed a return to a balanced supply-demand pattern in 1958 after a decade first of scarcity and later of overproduction. A sharp drop in production was responsible for reversing the trend and resulted in shipments exceeding production by a substantial margin during the year and producer stocks showing a decline. The price quoted for selenium was stabilized after a decline in February. Estimated imports are slightly higher than 1957, and exports continued to be negligible. The use of high-purity selenium as a semi-conductor in rectifiers was the major consuming outlet for the element.

The quoted price was lowered Feb. 19 to $7.00 a lb for commercial quality and $9.50 a lb for the high-purity grade, a decrease of $0.50 and $1.00 a lb respectively. The price remained throughout the year. Imports from Canada, Japan, and West Germany totaled 111,443 lb for the first eight months or at a projected annual rate of about 167,000 lb. During this period Canada provided 70% of the total imports, Japan 26%, and West Germany 4%. This does not include selenium contained in lead flue-dust imported from Mexico and Rhodesia-Nyasaland.

Companies reporting selenium production and shipments during the year were: Allied Chemical Corp., Marcus Hook, Pa.; American Metal Climax, Inc., Carteret, N. J.; American Smelting & Refining Co., Baltimore, Md.; International Smelting & Refining Co., Perth Amboy, N. J.; Kawecki Chemical Co., Boyertown, Pa.; and Kennecott Copper Corp., Garfield, Utah. Eight of the major North American selenium and tellurium producers announced sponsorship during the year of a research program at the Battelle Memorial Institute to further the understanding and use of the two elements. The group is termed the "Selenium and Tellurium Development Committee."

Although competition was noticed from germanium and high-purity silicon in rectifier manufacture, an estimated 12-million selenium rectifiers were manufactured during 1958 valued at an estimated $18-million, a decline from the previous year. Selenium was mentioned with tellurium as having favorable semiconductor performance characteristics as a component of thermoelectric devices and these two elements anticipate important applications in this new semiconductor development.

Selenium Statistics

(Pounds)

	1958 estimated	1957
Production	678,000	1,077,000
Producers' shipments	716,000	625,000
Producers' stocks	613,000	651,000

The major development in selenium production technology during 1958 was the International Nickel Co. announcement that a new electrorefining process, which permitted the recovery of elemental selenium, was placed in commercial operation at the company's Port Colborne, Ontario, Canada refinery.

Selenium remained in Group I of the national stockpile List of Critical and Strategic Materials throughout the year. OCDM included selenium among minerals eligible for Government financial participation up to 75% in Office of Minerals Exploration projects, and the element also was on the Department of Agriculture Barter Program during 1958•

Bismuth

H. M. Callaway
U.S. Bureau of Mines

SHARPLY DECREASED industrial consumption and attendant stock buildups characterized bismuth in 1958. Government acquisitions and diminished imports somewhat lessened the oversupply.

Domestic output of metal was almost exclusively from refining lead bullion containing bismuth as an impurity. The rather inflexible nature of its production would indicate the quantity produced in 1957 was approximately the same as that of the previous year. There was increased interest in redeeming both metal and alloys from scrap, but quantitatively the secondary contribution to total supply was insignificant.

As evinced by the pattern established during the first nine months of the year, imports of bismuth metal decreased to 536,000 lb. Peru and Mexico, the traditionally larger contributors, shipped 30% less metal in 1958 than in the previous year. The decrease is probably attributable to two factors: (1) the contracted U.S. market; and (2) a shift in the metallurgical mix such that a larger quantity of bismuth entered the U.S. in lead bullion and other untabulated intermediate smelter products.

Bismuth Metal Statistics

(Thousands of pounds)

	1958 estimated	1957
Consumption	1,100	1,615
Imports	536	848
Exports (includes alloys)	280	158
Quoted price, per pound	$2.25	$2.25
Consumers' and dealers' stocks (end of year)	600	348

Exports of metallic bismuth and bismuth alloys totaled 280,000 lb during the year, up 75% from 1957. The segment of exports that was metal and that which was finished products is unknown. However, the fact of domestic oversupply suggests the increased exports represent primary metal displaced by the shrinkage in the domestic demand. (*Continued*)

"High purity silicon consumption is expected to double in 1959, and U. S. capacity is already prepared to handle it." p 99

H. Austin Tucker
Commodity Specialist, U.S. Bureau of Mines

"Production of reactor-grade zirconium metal continued to increase. A large civilian market is still several years in the future. Supply overtook demand in 1958." p 100

F. W. Wessel
Commodity Specialist, U.S. Bureau of Mines

Consumption slid to 1.1-million lb —a 32% decline from 1957. The early months of 1958 continued the downward trend established in the latter half of 1957, reaching the trough in mid-summer, and beginning an upward swing in the fall of the year 1958.

Forty-five percent of the total industrial use of metal was in low-melting-point alloys and in alloys valued for their controllable dimensional changes. Pharmaceuticals such as indigestion remedies, ulcer medicine and anti-syphilitic drugs together with industrial chemicals such as porcelain pigment and cosmetics accounted for 33% of the bismuth consumed in the year 1958.

The remaining 22% was used in bearing alloys, iron, steel and aluminum alloys and in experimental and miscellaneous uses.

The anticipated large "puts" of demand from semiconductor fabricators and from atomic reactor experimenters did not materialize in 1958, though there remains considerable potential in the area of each of these new uses.

Bismuth telluride was the most popular thermoelectric element considered for non-mechanical refrigerators and air-conditioner units. However, the rapidly advancing technology of solid-state behavior threatened to displace the compound in favor of materials in more assured supply. Under an AEC contract, experiments continued toward the development of a liquid metal thermal reactor using molten bismuth as the fuel solvent.

Stocks of metal in consumers' and dealers' warehouses continued to grow in proportion to the decline in consumption, to total over 600,000 lb at year end. The increase was 72% above the stocks on hand Jan. 1. Quoted price remained at $2.25 per lb.

The inherent qualities of bismuth and its alloys suggest continued expansion of its current uses at a rate proportional to the expanding economy. New uses of fusible alloys will probably offset some shrinkage in pharmaceuticals. In addition, it now seems likely that one of many of the metal's peculiar solid-state or nuclear characteristics will eventually open large new markets•

Lithium

Albert E. Schreck
U.S Bureau of Mines

THE INDUSTRY in 1958 reflected no great changes from the previous year. No new firms entered the picture and there was no significant expansion of existing facilities. The greatest emphasis was placed on development of markets.

Domestic production of lithium minerals was centered at Foote Mineral Co.'s Kings Mountain, N. C., quarry; Maywood Chemical Co.'s Etta mine in South Dakota; and several other small operations in the Black Hills. American Potash & Chemical Corp. continued to recover di-lithium sodium phosphate from the brines of Searles Lake, Calif., and convert it to lithium carbonate at its Trona plant. A portion of lithium mineral requirements was supplied by spodumene concentrate from Canada and lepidolite from Southern Rhodesia. Bikita Minerals Ltd., a Rhodesian lepidolite producer, announced a 40% reduction in 1958 output.

Foote and Maywood produced a variety of lithium compounds from domestic ores, while Lithium Corp. of America continued to produce lithium compounds from spodumene concentrate from Canada, and American Lithium Chemicals Inc. converted Rhodesian lepidolite to lithium hydroxide at its San Antonio, Tex., plant.

Ceramics and grease remained the leading commercial consumers of lithium. In a survey of the grease industry, sponsored by the American Lithium Institute, it was revealed that 72% of the grease manufacturers reporting produce lithium-based greases. In the same report it was estimated that by 1965 almost 42% of U. S. automotive grease output will be lithium-base grease, representing about 250-million lb per year.

Other applications of lithium compounds include the use of lithium hydroxide in alkaline storage batteries, lithium bromide and chloride in industrial air conditioning systems, the fluoride and chloride in welding and brazing compounds, and the use of lithium metal as a degasifier and deoxidizer in metal manufacture and in organic synthesis.

Research continued on applications in high-energy chemical fuels, in various types of lightweight alloys, and numerous other potential applications.

The lithium chemical industry, already plagued with an over-capacity, when compared to commercial consumption, found itself faced with additional problems during the year.

One was the increased imports of lithium compounds from Brazil, which because of its cheaper price, was giving stiff competition to domestic production. In Brazil, Orquima, S. A. of Sao Paulo is reported to produce 300 tons of compounds per year, most of which is exported to the U. S.

The increased accumulation of lithium hydroxide residue from the lithium 6 istope extraction process of the AEC also posed problems for the industry.

Another problem facing the industry, although not of immediate concern during 1958, is the fact that AEC contracts expire during 1959 and 1960. Should contracts not be renewed, a cutback in chemical output by the three firms under contract (Foote, LCA, and American Lithium Chemicals) undoubtedly will occur. [Foote announced a cutback at the Sunbright plant in North Carolina at year-end, due to reduced AEC requirements.—Ed.]

New developments during the year included the announcement of commercial production of lithium perchlorate by LCA and also that the firm entered an agreement with

Brooks and Perkins, Inc. of Detroit (fabricators of magnesium and alloys) for research and development of lithium alloys.

The American Lithium Institute, founded in late 1956, was disbanded in June 1958. The Institute before its demise finished a monograph on lithium for the American Chemical Society, which is due for publication in early 1959.

The long-term outlook for the lithium industry continues to be promising. However, the immediate future seems to hold some pitfalls and may provide some rough going for the industry in the next few years•

Cadmium

Arnold M. Lansche
U.S. Bureau of Mines

THE RECESSION which affected the nation as a whole in early 1958, and imposition of import quotas on lead-zinc ores and concentrates in the latter part of the year, acted together to reduce domestic output of cadmium metal about 14% as compared with 1957. Combined domestic production of primary and secondary cadmium in 1958 was about 9.1-million lb; total supply, consisting of production and metal imports, was 9.9-million lb, about 30% above the 7.6-million lb apparently consumed. Supply exceeded demand for the third successive year. Apparent consumption dropped approximately 31% from 1957.

Metal producers shipments of cadmium, including those for internal consumption, declined about 34% compared with 1957 to 6.7-million lb. On Sept. 30, 1958, producers' stocks were at 5.1-million lb, or about 54% above those at the beginning of the year; cadmium compound producers' stocks were 119,000 lb or 21% greater, whereas distributors' stocks declined 29% to 155,000 pounds.

General imports of metal decreased 52% to 761,000 lb compared to 1957. General imports of flue dust, cadmium content, was about 1.2-million, or down 21%. Cadmium exported, including metal, alloys, dross, flue dust, residues, and scrap together, approximated 471,000 lb or about one-third less than in 1957. Exports went to Canada, Mexico, Peru, Brazil, U. K. (the largest recipient), Netherlands, West Germany, Switzerland, and the Philippine Islands.

The quoted price declined from $1.55 a lb to $1.45 under the impetus of competition and a lowered world price. The price of zinc, one of its chief competitive materials, on the other hand, increased from 10c to 11.5c a lb, E. St. Louis.

Electroplating used most of the cadmium consumed; other uses were in pigment manufacture, silver-brazing and other low-melting-point alloys, stabilizers against heat and light in vinyl plastics, batteries, and nuclear reactors.

The Department of Agriculture announced in November 1958 that cadmium was one of the materials which may be acquired for the supplemental stockpile through barter or exchange transactions, as authorized by Section 303 of the Agricultural Trade Development and Assistance Act of 1954, as amended.

Research. Wright Air Development Center, Ohio, has perfected its cadmium sulphide electric generator to the point where the generator produces more than 8 volts of electricity when impinged by sunlight. Ethyl Corp. reported that cadmium, believed to be in the form of diethylcadmium, assists importantly in a new process for manufacturing tetraethyl lead. In this reaction the lead is almost completely converted to tetraethyl lead, and the cadmium is recycled.

Outlook for 1959 from the standpoint of production will depend on the level of U.S. lead-zinc mining and smelting and on imports of cadmium-bearing base-metal concentrates and flue dust. Prospects for increasing consumption of cadium appear to be good in view of the improved business conditions that characterized the latter part of 1958, the lower price for the metal, and the long-term economic outlook•

Rare Earths

Howard E. Kremers
Lindsay Chemicals Div., American Potash & Chemical Corp.

THE CHIEF SOURCE of domestic rare earth and thorium production was monazite ore imported from the Union of South Africa. Production of thorium chemicals for Government contracts and commercial uses continued to create surplus crudes of the lighter rare earths.

Domestic ore production generally continued on a smaller scale than in 1957. Bastnaesite was produced from the Molydenum Corp. of America's deposit at Mountain Pass, Calif. Production of monazite sand from the Horse Creek placers near Aiken, S.C. was stopped, and production of by-product material from ilmenite-rutile-zircon mining in Florida decreased.

By-product production of monazite sand from the euxenite mining at Bear Valley, Idaho by Porter Bros. continued. Limited production of ores of the heavier rare earths continued from small deposits in the Western States.

Processors. Lindsay Chemical Div., of American Potash & Chemical Corp., Michigan Chemical Co., Heavy Minerals Co., and Davison Chemical Co. continued to be dominant in the commercial processing of ores. Mallinckrodt Chemical Works processed Idaho euxenite to recover uranium, columbium, tantalum, and thorium-rare earth concentrates for GSA. Metallurgical use of rare earth compounds was obtained primarily from bastnaesite processed by Molybdenum Corp.

Several smaller specialized companies processed smaller amounts of ores and semi-refined rare earth materials.

Prices. Large contract prices for monazite remained unchanged at about $250 per net short ton delivered for ore containing 6% ThO_2 and 45% rare earth oxide. There was considerable softening in prices for small lots of imported monazite, and purchases were made in the range of $100 to $200 per short ton delivered.

Prices for rare earth oxides from

(*Continued on page 155*)

Major Metals

Zinc

Charles R. Ince
St. Joseph Lead Co.

THE ZINC MARKET in 1958 reversed a 3-year cycle and ended the year with a lower surplus of supply than that which prevailed the previous year. This was partly due to a pick-up in consumption the latter part of the year but was mainly accomplished the hard way—by curtailing production. Throughout the first three quarters, the price remained steady at 10c a lb, continuing the level established in July 1957. While such stability in price may be welcome to consumers, it was at a level that brought small comfort to producers. Mine production in the U.S. declined 28% and foreign output was likewise affected although not to as great an extent. Even before the imposition of quotas in the last quarter of the year, imports of metal had dropped 30% and the zinc situation was being brought into balance by the inexorable law of supply and demand. The announcement of Government control of imports during the last quarter hastened the recovery in price and rapidly moved the market to 11.5c where it stood at the end of the year. Thus, 1958 ended on a favorable note with the consumption up substantially from a low of the first half and a 15% higher and stronger price.

The Government was a material influence in the market throughout the year. During the first six months the continuance of purchases of domestic metal for stockpile and the acquisition of metal of foreign origin by means of barter buoyed up the market through the period when the "so-called" recession was leveling out and before business had begun its upturn. Otherwise prices might have broken to the 1954 low of 9.25c. During the last quarter, it was the Administration's imposition of import quotas which sparked the advance in price. It will be recalled that late in the preceding year the lead and zinc industries, after exhausting the possibilities of Congressional aid, had appealed to the Tariff Commission for relief from excessive imports under the "escape clause" of the Reciprocal Trade Agreements Act. In the Spring of 1958 the Tariff Commission rendered its decision and was unanimously in favor of an increase in duties, though divided on the extent of the increases and also on the question of quotas which the industry had included in its appeal. The Republican half of the Commission was in favor of the maximum increase in duties permissible and also the imposition of quotas, while the Democratic side favored a tariff increase only and to a lesser degree. The President did not act immediately on the Tariff Commission's recommendation as there was before Congress at the time an Administration-sponsored subsidy plan ("the Seaton Bill") which would have provided an outright Federal subsidy to mines similar to that which farmers are granted. This bill failed to pass and finally on Sept. 22 the Administration announced the imposition of quotas on metal and ore—this presumably being more palliative abroad than an increase in duties. The impact of the quota system on the supply situation can be judged from Table I. While the quotas are based on 80% of the five year 1953 through 1957 period, it can be seen that they are more restrictive than this with respect to recent imports, particularly ores and concentrates.

During the period of uncertainty as to what, if any, legislative aid might be granted the industry, consumption of zinc, which in the final analysis will determine the well-being of the metal producers, continued the even tenor of its way and followed the industrial activity of the economy. As the Federal Reserve Board Index of Industrial Activity declined to a four year low of 126 at the end of the first quarter, so did zinc usage. Starting the second quarter, as the Federal Reserve Board index began to rise, metal consumption picked up slowly and by the third quarter was definitely on the upgrade. By August it was evident that the current rate of smelter production plus reduced metal imports was unable to take care of demand and the first substantial reduction of smelter stocks took place. A further reduction occurred in September and, spurred on by the buying which took place as the price rose at the beginning of the last quarter, stocks dropped rapidly. At the end of the year, producers' inventories had declined 68,000 tons from their mid-year peak (Table II). Admittedly, part of this was a tranfer to consumers' stocks in view of the stronger market but a substantial portion could be attributed to a further pickup in consumption as the FRB index rose to 141 in the last quarter.

Not all uses of the metal shared equally in the rise nor had they all shown the same decline. As can be seen by Table III on Consumption by Industries, galvanizing was the largest outlet for the metal and also gave the best account of itself throughout the year, mainly due to the sheet and strip segment of the industry. This again emphasizes the important part that continuous galvanizing is playing in the expanding use of zinc as the "protective metal." The unique properties of this type of coating which permits the coated metal to undergo the most rigorous forming operations such as stamping and extrusions without cracking the zinc layer, has opened up applications for the galvanized product which were impossible a few years ago. Galvanized sheet shipments reached a total of around 2.8-million tons and represented close to 5% of shipments of all steel products as compared to 2.4-million tons and 3% the year before. October shipments of 290,000 tons were the highest since March of 1956. At year end, galvanized steel orders were on a "wait list" basis. Certainly, this type of galvaning can well be called a "growth" industry despite the age of the process. The use of zinc for this purpose has

"For iron and steel, the year 1958 was one of technical momentum—a year which saw direct reduction of iron ore get off to a rolling start. Production was down 30%." p 132

A. W. Knoerr
Editor, E&MJ

Table I Zinc Imports

(short tons)

	Monthly quotas	Average/ month, 1st 6 mos., 1958*	% Change due to quotas	Average/ month 1957*	% Change due to quotas
Metal:					
Canada	6,307	5,181	+22.0	8,330	−24.4
Belgium-Lux	1,252	1,296	− 3.0	2,343	−46.5
Mexico	1,053	1,619	−35.0	1,150	− 8.4
Belgian Congo	907	2,049	−61.0	2,107	−56.8
Peru	627	1,059	−41.0	1,396	−55.0
Italy	600	376	+60.0	528	+13.6
Other	1,013	1,011	–	1,008	–
	11,760	12,591	− 7.0	16,862	−30.2
Ore:					
Mexico	11,747	15,570	−25.0	16,043	−27.0
Canada	11,060	13,637	−19.0	13,185	−16.0
Peru	5,653	9,425	−40.0	9,898	−41.0
Other	2,973	5,602	−47.0	4,686	−37.0
	31,433	44,234	−29.0	43,812	−28.0

* Exclusive of metal entered free for delivery to Government stockpile under barter, which is ex-quota.

Table II Total Slab Zinc Smelter Output

(All grades—short tons)

			Shipments				
1958	Stock beginning	Production	Domestic	Export & drawback	Gov't acct.	Total	Stock at end
Jan.	166,660	82,343	58,211	641	9,805	68,657	180,346
Feb.	180,346	68,354	49,072	446	9,993	59,511	189,189
Mar.	189,189	72,274	48,948	111	8,763	57,822	203,641
Apr.	203,641	70,214	46,598	159	5,927	52,684	221,171
May	221,171	71,018	51,390	129	–	51,519	240,670
June	240,670	66,967	54,487	171	–	54,658	252,979
July	252,979	65,119	60,132	55	–	60,187	257,911
Aug.	257,911	62,927	68,718	591	–	69,309	251,529
Sept.	251,529	63,705	76,905	213	–	77,118	238,116
Oct.	238,116	65,304	93,018	226	–	93,244	210,176
Nov.	210,176	65,174	83,394	212	–	83,606	191,744
Dec.	191,744	75,503	76,862	148	–	77,010	190,237
Year to date	828,902	767,735	3,102	34,488	805,325		
Monthly avg.	69,075	63,978	258	2,874	67,110		

U. S. Slab Zinc Production & Stocks

	1958 production	Stock at 12/31/57	Stock at 6/30/58	Stock at 12/31/58
Special High Grade	**303,304**	40,177	87,003	52,921
High Grade	**67,644**	11,014	20,987	9,236
Intermediate	**20,257**	5,910	5,346	3,874
Prime Western, etc.	**437,697**	109,559	139,643	124,206
Total	**828,902**	166,660	252,979	190,237

"Bismuth consumption declined and stocks built up during 1958." p 104 . . . "Antimony stocks at year-end were about the same as those of Jan. 1, imports dropped 40%." p 103

H. M. Callaway
Commodity Specialist, U.S. Bureau of Mines

resumed its upward movement after a lull in 1957 from the 1956 peak, and might well be expected to surpass that this year.

Die casting, which has vied with galvanizing in recent years as the largest outlet of the metal, declined to the lowest point since 1954, chiefly due to the drop in automotive production which accounts for about 60% of die casting usage. The decline in the Durable Manufacturers index from an average of 160 in 1957 to a low of 131 and an average of 144 this past year, was also a contributing factor. Despite this setback to the die casters in 1958 the industry is expanding its applications and as "the shortest distance between raw material and finished product" will continue to grow, providing new markets for zinc.

Brass mills, the third most important use of zinc, had a disappointing year throughout most of 1958. Imports of brass, based on the lower copper and zinc prices which prevailed abroad during the year, accounted for a loss of some of the markets, particularly in the East. Also, the extremely high price of copper during the previous year had discouraged the use of brass products in some applications—which markets will not be easy to regain despite the more reasonable price levels which have prevailed since. Furthermore, a shortage of "red metal" developed in the latter part of 1958 due to strikes here and abroad at a time when business activity was picking up and there might have been a chance of reestablishing some of the markets for brass mill products.

Rolling mills, which account for a little less than 5% of the total zinc consumed, made a better than average showing with a decline of 7%. Dry cell battery cans continued to be the main outlet for the strip, while engravers' plates and hull plates for cathodic protection accounted for the major part of the sheet production. During the year a great deal of interest developed in a titanium-zinc alloy in the rolling industry, which appears to have unique creep and tensile properties. Further study of this alloy's other physical characteristics and casting and rolling properties will be necessary before its commercial possibilities can be evaluated.

Total shipments of lead-free zinc oxide to domestic consumers in 1958 are estimated to have been about 154,000 tons, a decline of 4% from 1957. The rubber industry, which consumes about 50% of the total zinc oxide, largely accounted for this. Total domestic rubber consumption declined

9% to 1,330,000 long tons, and total tire sales declined 7%. Had it not been an excellent year for replacement tires and recaps, rubber consumption would have declined much more. The paint industry, which normally consumes about 20% of the total zinc oxide, enjoyed an excellent year. 1958, however, saw domestic primary zinc oxide producers seriously affected by competition from secondary and imported zinc oxides, many of which were excellent quality French Process types, being offered at prices 1.5c to 2.5c per lb below the market. This situation was brought about largely by the depressed metal price, whereas the price of zinc oxide remained stable and firm, so that imports doubled in 1958 to about 10,000 tons, and secondary zinc oxides increased 15% to about 32,000 tons. This resulted in a decline in domestic American Process shipments of 11% to 90,000 tons, and in domestic primary French Process shipments of 18% to about 22,000 tons.

Ways to increase usage of zinc oxide are being actively studied by the Zinc Pigments Committee of the American Zinc Institute, and through cooperative efforts of the staffs of the member companies, much has been accomplished to strengthen the position of zinc oxide in the paint industry. 1959 should be a good year for zinc oxide consumption; the paint industry is expected to exceed its 1958 sales and it is estimated that rubber consumption will increase 13% to 1.5-million long tons. How much of this increased zinc oxide business will be lost to secondary and imported materials will depend largely on supply, demand and price conditions for zinc metal.

"All other" uses, which cover a myriad of miscellaneous applications of the metal, accounted for a little over 1,000 tons a month which was a substantial decline from the previous year's rate. Among the applications in this category are wet batteries, zinc used for desilverizing lead, light-metal alloys, zinc dust, chemicals, etc. Naturally, the drop in domestic lead production accounts for the decrease in the use of zinc in desilverizing and the light-metal field was materially affected by the lower rate of aircraft production.

The lower consumption in 1958, despite an increase in population to 175-million, dropped the per capita consumption to 9.5 lb from the 10-year average of 11.5—and emphasizes the importance of promotion and research in expanding old markets and developing new ones for the metal. This the zinc industry has been doing individually in the past on a limited scale. Within the last year a collective effort has been started in the form of the Joint Research Program of the American Zinc Institute and Lead Industries Association. The research program has no set limit on expenditures. Financial backing for the new project will be provided by 20 producers of zinc and lead from seven nations. It is planned to commission universities, research agencies and institutions throughout the world to develop new knowledge and create new products and uses for the two metals.

Table III Consumption by Industries

	1957	1958*	% change from 1957
Galvanizing:			
Pipe, wire, etc.	200,000	**183,000**	− 8
Sheet and strip	168,000	**187,000**	+11
	368,000	**370,000**	
Brass and bronze	112,000	**96,000**	−15
Zinc-base alloys	376,000	**293,000**	−23
Rolling mills	41,000	**38,000**	− 7
Oxide	20,000	**13,000**	−35
All other uses	18,000	**13,000**	−27
	935,000	**823,000**	−12

* Last quarter estimated

In technology, development of the Imperial blast furnace continues. A second, larger unit is being erected at Avonmouth, England; Pennarroua Co. is building one at Noyelles Godault, France; and Consolidated Zince Corp. expects to have another on-stream at Cockle Creek, Australia in 1960.

There are many favorable factors in the situation which should be taken into consideration in appraising the current year. In the first place, consumption is at a substantially higher rate than that which prevailed a year ago and if continued, could mean the highest zinc consumption since 1955. Secondly, the excess imports which have plagued the industry in the last two years were under control and at a level which could provide a measure of protection for the domestic mining industry. As can be seen from the "balance sheet" of the zinc industry shown in Table IV, the hold-down on imports of metal and concentrates, coupled with the improvement in consumption, indicates a deficit during the first six months and could be a continuing one if the economy's industrial activity holds to 141 or higher. However, with producers' stocks at 190,000 tons at the end of the year, there need be no concern as to availability of the metal and the stronger market could provide an incentive for an increase in domestic production•

Table IV Zinc Balance Sheet

	1957	1958 (Last quarter estimated)	1959* (First six months)
Consumption	936,000	**823,000**	**480,000** (1)
Supply:			
Mine production	532,000	**400,000**	**220,000** (2)
Secondary	72,000	**40,000**	**35,000** (3)
Concentrate imports	526,000	**442,000**	**168,000** (4)
Metal imports (net)	253,000	**183,000**	**65,000** (5)
	1,383,000	**1,065,000**	**488,000**
Less zinc used in American Process oxide	108,000	**87,000**	**48,000**
	1,275,000	**978,000**	**440,000**
Surplus	339,000	**155,000**	**−40,000**
Surplus disposed of as follows:			
Barter	66,000	**40,000**	
Stockpile	179,000	**34,000**	
Producers' stocks:			
Metal	98,000	**23,000**	
Concentrates	−34,000	**6,000**	
All other	30,000	**58,000**	

* Estimates as follows:

(1) Consumption—up 17% over 1958 rate
(2) Mine production—5% higher than 1958 rate
(3) 1957 rate
(4) Quota (recoverable metal)
(5) Quota less exports

Lead

Robert L. Ziegfeld
Lead Industries Association

THE MARKET DECLINE that started in 1957 continued throughout a good part of 1958 as a result of continued world overproduction, cessation of U.S. Government stockpiling and the general business recession. The New York price tumbled from 13c per lb to a low of 10¾c. The President declined to act on the Tariff Commission's recommendation for higher tariffs but established a quota system to limit lead imports as of Oct. 1 which served, along with some pick-up in consumption, to strengthen the domestic market. As a result the domestic price recovered and closed the year again at 13c.

For several years U.S. Government stockpiling of domestically produced lead had been a strengthening factor in the lead market. Another such factor had been the barter of surplus U.S. agricultural commodities for foreign lead for stockpile. Stockpile purchases of domestic lead ceased in the middle of 1958 after amounting to about 35,000 tons or roughly 6,000 tons in the first half of the year. Likewise, such stringent restrictions were placed on barter deals that, although they amounted to over 40,000 tons or roughly 7,000 tons in the first half of the year, only a few thousand tons were bartered in the remainder of the year. Thus, while shipments to stockpile in both cases totaled some 150,000 tons in 1957, they were reduced to only about 85,000 tons in 1958, most of this being bought in the first six months of the year.

Production. Under the influence of the depressed price, U.S. mine production took a further substantial cut of over 20%. This amounted to an average of about 6,000 tons per month, although at the year end, with better prices, production had recovered somewhat from the low. At 265,000 tons this was the lowest U.S. mine production of lead reported for any year since about the turn of the century. Despite this substantial cut in production, U.S. producers' stocks in all forms continued to increase and at the end of 1958 were a little over 300,000 tons, an increase of nearly 125,000 tons during the year.

At the same time, production in the Free World outside the U.S. showed declined of something less than 5% and refinery stocks outside the U.S. were reduced moderately during the year.

Secondary lead production in this country also underwent a substantial cut (about 15%) and is estimated at 420,000 tons for 1958.

Imports. Foreign lead was again imported into the U.S. in large quantities despite the quota restrictions which applied during the last quarter. Heavy imports earlier in the year anticipated the imposition of some controls. Although imports of lead in ore were off about 14,000 tons to about 184,000 tons, refined metal imports increased about 27,000 tons to a little over 350,000 tons. Total net imports for 1957 and 1958 were about 522,000 and 535,000 tons respectively.

After the imposition of quotas late in the year, offerings of lead products manufactured abroad began to make themselves felt in this country. This came about because the quotas only applied to raw materials and not to manufactured items. With a spread of around 4c a pound between the foreign and domestic price, the items could be offered here substantially under the domestic price for similar articles and thus circumvent the quota restrictions.

Consumption. In the first half of 1958 consumption was running about 20% behind 1957, but improved business in the fall brought the decline down to about 13% for the year. Nevertheless, at an estimated 992,000 tons, consumption was under a million tons for the first time since 1949 and was the lowest since that year. The decline in consumption was distributed pretty generally throughout the major lead products with the exception of calking lead and ammunition, which showed little change. Consumers' stocks of pig lead remained at a moderate level throughout the year and showed little change.

Prices. The following table shows the New York price changes for pig lead during the year as quoted by *Engineering & Mining Journal:*

Lead Price Changes
(Cents per lb N.Y.)

Dec. 2, 1957	13.00
April 1, 1958	12.00
May 14	11.50
June 3	11.00
June 18	11.50
July 2	11.00
Aug. 13	10.75
Sept. 18	11.00
Sept. 30	11.50
Oct. 2	12.00
Oct. 8	12.50
Oct. 14	13.00

After the imposition of quotas the domestic price improved materially, aided by increased consumption. However, the London price remained in the area of 9c plus, resulting in a spread of about 4c per pound, far in excess of normal spread.

Tariffs, subsidies and quotas. With the conditions that prevailed in the domestic lead market during the early part of the year, namely low consumption, high imports and the imminent end of stockpiling, and faced with substantial curtailment of domestic production, domestic producers sought relief in Washington. The Tariff Commission had held hearings late in 1957 on greater protection for domestic producers. On April 24, 1958, it finally reported its findings.

The Commission split equally in its recommendations, three members favoring the full tariff increase permissible under the law, to 2.55c per lb, on pig lead from 1$\frac{1}{16}$c then prevailing, and imposition of import quotas. The other three members favored increasing the duty to the old 1930 rate of 2½c per lb but no quotas.

A few days later the Secretary of the Interior presented a subsidy plan

"Domestic production of tungsten concentrate reverted to the 1949-50 level. Virtually all domestic output was from two operations, both depending upon moly content of their ores." p 152

Robert W. Holliday
Commodity Specialist, U.S. Bureau of Mines

to a Senate Interior Committee intended to stabilize lead at 14¾c up to 350,000 tons of domestic production. This was followed up in late May by sending a draft bill to Congress providing for a maximum lead subsidy of 3⅜c per lb. Various other bills and proposals were also submitted to Congress and on June 19 the President wrote to both Houses that he was deferring action on the Tariff Commission's recommendations pending consideration of Interior Department's subsidy plan. The Senate later passed the bill with some modifications and the House Interior Committee cleared a somewhat similar bill to the Rules Committee. However, Congress adjourned without having passed this or similar legislation.

In early September an international study group met in London to discuss the problems of the lead and zinc industries. Only a few days later the President in Washington and Interior Secretary Seaton speaking before the American Mining Congress in San Francisco simultaneously announced the imposition of import quotas on Oct. 1 equaling the average imports for the years 1953-1957. This met with severe criticism from foreign producers but has been in effect since.

A second international meeting under United Nations auspices was held in Geneva in November and, while there apparently was general agreement that world overproduction existed, no positive action was taken except that another meeting should be held after further study by individual countries. The next meeting is expected in March 1959.

Research and market development. Meanwhile a group of Free World lead producers had been attacking the problem from a different angle. Realizing that there was one solution which would make everybody happy, namely increased consumption, this group set about planning a greatly expanded program for research to develop new products and markets. This is now a reality and is being supported financially by lead producers in the U. S., Great Britain, Canada, Mexico, South America, Australia and Africa.

During 1958 the market development and research activities of the Lead Industries Association were greatly expanded with further expansion already approved for 1959. Beginning Sept. 1 the expanded research program, and that of the American Zinc Institute as well, was placed under a new research director for both organizations, Dr. Schrade F. Radtke. Already a number of research contracts have been placed with research organizations, universities, private companies and elsewhere. The fact that lead is finding new applications in some of the most modern growth industries like atomics, electronics and thermo-electrics indicates a bright long-term future. The properties of lead are so unique and so useful to modern technology that well-planned and intensive research and market development are certain to open new horizons in time.

Some of the new uses of lead that excite the imagination are cited here as not necessarily implying large consumption in any one development but to give some idea of how lead fits into modern technology. Recent research has shown that treatment with certain lead compounds can materially improve some of the useful properties of cotton. Lead zirconate-titanate is at the heart of some of the much publicized stereophonic sound pick-up devices. A special lead pigment improves movie screens and is also used to produce articles with artificial mother-of-pearl finishes. The properties of lead are being used to control vibration in the most modern laboratories employing extremely sensitive instruments. Lead alloys are finding use as non-sacrificial anodes for corrosion protection.

For the nearby future lead will be more dependent on general business conditions. Judging from the past year when lead consumption showed substantial improvement in the second half, continued improvement in business should bring about a better year for lead in 1959.

If the predicted improvement in sales of new automobiles materializes, consumption of lead in batteries will benefit. Another million cars produced could mean up to another 10,000 tons of lead consumed in batteries. Solder consumption would also benefit. It is likely, too, that after a disappointing 1958, sales of replacement automobile batteries may improve. Accelerated highway construction should continue to require more

"Vermiculite industry operations, in general, were profitable through 1958. New applications and recent patents promise greater consumption." *p 140*

William S. Steele
President, American Vermiculite Corp.

U.S. Lead Supply and Demand[1]

(Short tons)

	1958 estimated	1957
Supply:		
Mine production	265,000	338,200
Secondary production	420,000	489,200
Imports:		
Ore, matte, etc.	184,000	197,900
Pigs and bars	351,000	324,300
Total	1,220,000	1,349,600
Changes in stocks at primary smelters and refineries	125,000[2]	57,200[2]
Total	1,095,000	1,292,400
Exports	2,000	5,200
Total available	1,093,000	1,287,200
Demand:		
Industrial consumption	992,000	1,138,100
Est. stockpile shipments	85,000	148,000
Consumers and secondary smelter stocks	0	5,300[2]
Total	1,077,000	1,291,400

[1]American Bureau of Metal Statistics, U. S. Bureau of Mines and Lead Industries Association.

[2]Increase.

U.S. Lead Use*

(Short tons)

	1958 estimated	1957
White lead	12,500	15,700
Red lead and litharge	64,500	78,300
Storage batteries	326,700	361,000
Cable	74,000	108,200
Building	48,900	52,200
Tetraethyl lead	158,000	177,000
Ammunition	41,000	42,500
Foil	5,000	4,900
Bearing metal	21,000	27,000
Solder	58,000	70,700
Type metal	26,000	28,700
Calking lead	65,000	65,700
Other uses	91,400	106,300
	992,000	1,138,200

*Based on U. S. Bureau of Mines statistics.

"Future mining practice will be influenced by nuclear blasting and electromagnetic rock breaking as 'tools', and by industry's growing realization of the need for systematic research." p 159

Lloyd E. Antonides
Associate Editor, E&MJ

lead paints, particularly red lead primers and the new lead silicochromate top coats.

After an unbroken rise in lead consumption since it was introduced in the 1920's, tetraethyl lead has gone through two years of lower consumption. This was largely due to a number of new catalytic cracking plants that produced a larger pool of high grade base stock requiring less TEL per gallon. Sooner or later the demand for high octane gasoline will catch up with this supply and use of tetraethyl lead will again forge ahead. Also, the use of lead for cable sheath is continuing to meet strong competition.

High levels for home building indicate good consumption in that industry but much will also depend on what the chemical processing industries will do toward new plant construction or new equipment. One such new plant now planned will employ some 1,500 tons or more of sheet lead, and two tunnels for the Niagara Power Project, on which construction has started, will require over 500 tons of sheet lead.

One product which bears watching, although it consumes less than 2,000 tons of lead a year at present, is leaded steel. It usually contains only 0.15 to 0.35% lead but is now available and is being aggressively merchandised by some 20 steel companies not only in the familiar bar and tube stock for free machining but also as forgings and just recently as sheet and plate. This use definitely has a bright future•

Magnesium

J. Donald Hanawalt
Dow Chemical Co.

U.S. CONSUMPTION declined about 15% to 37,000 tons in 1958. This was due to three major factors: the business recession, the titanium slump (magnesium is used as a reducing agent in titanium sponge production) and the continuing effects of the slowdown in military procurement that started in the previous year. The forecast for consumption in 1959 is on the order of 44,000 tons, or about the same as the 1957 level.

Production of primary magnesium was about 30,000 tons in 1958 and is expected to be on the order of 25,000 to 30,000 tons in 1959. These figures reflect the inventory carryover from 1957, whose 81,000-ton production was a record for a peacetime year. The inventory was deliberately built up because Dow was uncertain over the disposition of the then Government-owned primary plant at Velasco, Tex.; the plant eventually was sold to Dow, the higher of two bidders.

A second primary producer, Alabama Metallurgical Corp., has announced plans to commence production in a plant of 6,000 ton capacity during the current year.

Increasing its prominence as a missile metal during 1958, magnesium is now designed into at least 20 different missile systems. Missile consumption of magnesium has replaced a part of the lost aircraft volume, and it appears that magnesium may eventually enjoy a larger share of the missile market than it did of the aircraft market. Consumption of magnesium-thorium alloys, which have increased the metal's operating range to 600-800 deg F, is still small but growing steadily.

Commercial uses accounted for nearly half of the magnesium consumed in 1958. Most important structural applications were luggage, portable tools, materials handling equipment, jigs and fixtures, office machines, ladders and cameras. Alloying with aluminum and cathodic protection were the principal nonstructural uses.

The technique for metered automatic feed of molten magnesium into cold-chamber die-casting machines was further evaluated by industry during the past year, and indications are that this process may put magnesium in a position to compete in the automotive die-casting market.

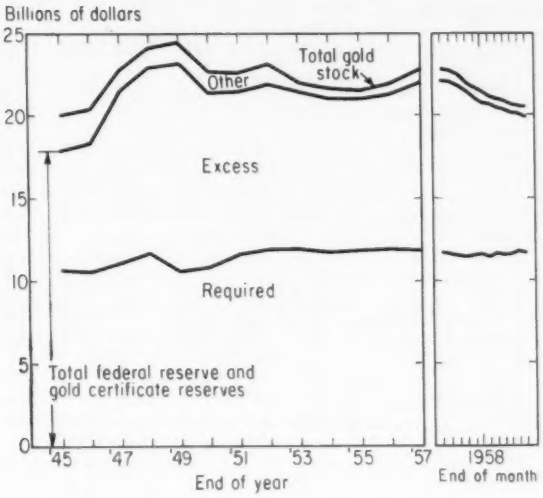
A new alloy with an exceptional capacity for damping vibration was introduced and is now being utilized in aircraft and missile electronic equipment. A new sheet and plate alloy and a new extrusion alloy that do not require stress relief after welding also were put on the market. The flatness tolerances for magnesium tooling plate were tightened. Two new finishing techniques for magnesium, an electroless nickel plate and a clear anodize, were introduced.

A number of other technological gains are scheduled for release during the current year. These include a new die-casting alloy for elevated temperature applications, an aircraft sheet alloy with improved room-temperature properties, and a sand-casting alloy with a good combination of room-temperature yield strength and elevated-temperature properties. New tooling materials and a new method of producing magnesium templates are to be offered. New fasteners with improved galvanic corrosion resistance are expected on the market.

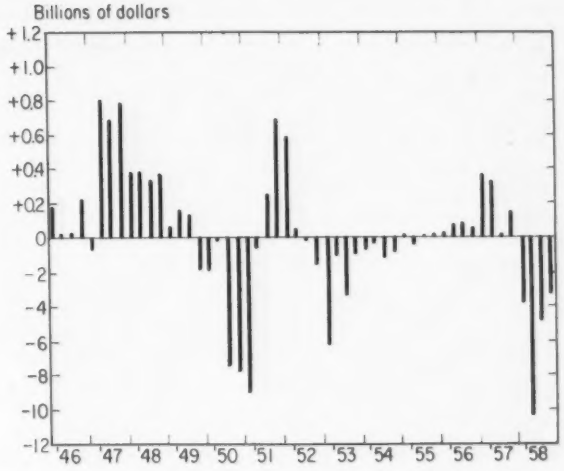
Magnesium continues to follow in the footsteps of the older metals by becoming more and more a mill products industry. Although sand castings still account for roughly half of all magnesium product shipments, the greatest growth is in sheet and extrusions. The large, integrated mill for magnesium sheet and extrusion production at Madison, Ill. will complete its fifth year of operation this spring. The mill has reached a high level of operating efficiency in producing a broad line of sheet and extruded products. The mill's newest product development is the precision extrusion, offered with tolerances as low as 0.001 in. on round wire, rod and bar.

Trend. In the sand-casting segment of the magnesium industry, there has been a strong trend to intricate, thin-walled work. The elevated-temperature alloys are being specified increasingly. Both developments reflect the current requirements of the military aircraft-missile market, which continues to be the chief consumer of magnesium sand castings•

U.S. Gold Stock



Changes in U.S. Gold Stock



Gold

Dr. M. A. Kriz
First National City Bank of N. Y.

WORLD PRODUCTION rose again in 1958—for the fifth consecutive year. At some 30.6-million fine oz (excluding output of the USSR), it was about 0.9-million oz more than in 1957, on the basis of preliminary or incomplete data available at the year-end. Last year's rise was therefore smaller than the 1.3-million increase in 1957, but about the same as in 1956. The current phase of expansion in world gold output had begun in 1954, following a period of relative stability from 1950 through 1953. Last year's output was 9.5-million oz above the 1945 postwar low and 6.1-million oz short of the 1940 all-time peak (see table and chart).

The 0.9-million oz rise in last year's output was due mainly to an increase in South African production. At some 17.7-million oz—the highest ever recorded—South Africa's output in 1958 was 0.7-million above the year previous. The increase was, however, smaller than during 1957, when it amounted to 1.1-million, and 1956, when it reached 1.3-million. Last year's production was 3.3-million oz above 1941, which was the record year that had marked the culmination of the last previous expansion phase.

The current rise in South African output, which began in 1952, had resulted by 1958 in an expansion of production by almost 50%. As in earlier years, the 1958 rise was attributable largely to the continuing increase in the output of the new mines of the Orange Free State, which have not yet reached their peak. It was in part the result of better yields per ton of ore, but there also was a marked improvement in the native labor force.

South Africa accounted last year for almost three fifths of world gold output (excluding the USSR). Total production of all the other countries rose last year by 0.2-million oz. This was attributable principally to the increases in Canada and Ghana. In the U.S., production remained at about 1.8-million oz. No official data of Russian gold output have been published since the late 1920's; estimates made independently of Soviet sources put Russian gold production in recent years at 10- to 17-million oz annually. Russia is undoubtedly the second largest world producer.

Mining costs continued to rise last year although more slowly than in 1956 and 1957. In South Africa, the average working costs per ton of ore milled reached the equivalent of $6.55 during the third quarter of 1958, as against $6.37 in the corresponding period of 1957; they had been at $4.14 in 1950, the year following the devaluation of the pound. Despite the increase in costs, total working profits from gold and uranium rose to $205-million during the first nine months of 1958, against $189-million during the same period of 1957. Working profits from gold alone amounted to $126-million during the first nine months of 1958, against $121-million a year previous, and those from uranium to $78-million, compared with $68-million. Profits thus continued the increase begun in 1952 to reach an all-time high.

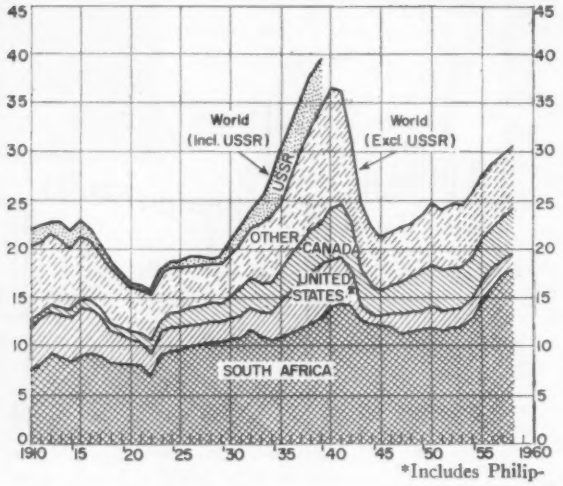
These aggregates for the industry as a whole conceal, however, the highly uneven results of the mines in the new rich areas of the Orange Free State and of the other mines on the Rand. In the new mines, the effect of the rise in costs was more than offset by increases in working revenue brought about by mining of higher grade ores. On the other hand, the old mines, owing to the absence of higher grade ore, were unable to raise the grade of the ore mined and thus preserve a reasonable margin of profit.

The gold subsidy programs of Australia, Canada, and Colombia remained in operation; a subsidy was under consideration in Ghana. Such subsidization is designed to benefit marginal producers, the amount of subsidy being related to the presumed economic needs of various categories of mines and subject to a number of conditions.

The turnover on the London gold market was much smaller in 1958 as central bank operations, the mainstay of the London market in 1956 and 1957, were greatly reduced. The basic reason was the strength of sterling which, after the pound's rapid recovery from the crisis of September 1957, relieved the United Kingdom authorities of the need to

World Gold Production

(Millions of fine oz)



*Includes Philippines through 1939.

	1958*	1957	1956	1955	1945	1940
North America:						
Canada	4.5	4.4	4.4	4.5	2.7	5.3
United States	1.8	1.8	1.9	1.9	0.9	4.9
Latin America:						
Mexico	0.4	0.4	0.4	0.4	0.5	0.9
Colombia	0.3	0.3	0.4	0.4	0.5	0.6
Chile	0.1	0.1	0.1	0.1	0.2	0.3
Nicaragua	0.2	0.2	0.2	0.2	0.2	0.2
Africa:						
Union of South Africa	17.7	17.0	15.9	14.6	12.2	14.0
Ghana	0.9	0.8	0.6	0.7	0.5	0.9
Southern Rhodesia	0.5	0.5	0.5	0.5	0.6	0.8
Belgian Congo	0.4	0.4	0.4	0.4	0.3	0.6
Asia:						
India	0.2	0.2	0.2	0.2	0.2	0.3
Philippines	0.4	0.4	0.4	0.4	–	1.1
Australia	1.1	1.1	1.0	1.1	0.7	1.6
Total	28.5	27.6	26.3	25.4	19.5	31.6
Other, excluding USSR	2.1	2.1	2.1	2.1	1.6	5.1
World, excluding USSR	30.6	29.7	28.4	27.5	21.1	36.7

* Tentative figures based on preliminary data.
Note: Figures may not add up to totals because of rounding.

sell gold—against U.S. dollars—to foreign central banks and private buyers, as during most of the earlier years.

Thus, the London market price for gold, expressed in U.S. dollars, rose—for the first time in recent years—above the U.S. Treasury's selling price of gold ($35.0875 per fine oz). As shown in the accompanying chart, this price reached its highest level in October—about $35.14—but subsequently declined and stood at the year end at $35.08. The rise in the London price made it, of course, cheaper for central banks to buy gold in New York than in London (at least for transactions in which shipping costs—about $0.14 per oz—were not involved). As will be noted below, a large cash deficit in the U.S. balance of payments enabled foreign countries to acquire $2.3-billion worth of gold from the U.S. Treasury. The bulk of newly mined gold was again sold in London where a much better price could be obtained than the U.S. Treasury's buying price of $34.9125 (see chart).

In the last days of 1958, the arrangements for dealing in gold on the London market were changed in a way that is likely to attract more bullion business there. Gold can now be bought or sold by persons residing outside the U.K. and the overseas sterling countries against the new "external account" sterling—not only, as heretofore, against American or Canadian account sterling or the so-called registered sterling, which could be acquired only for dollars. Gold purchases by sterling-area residents continue to be subject to license, which is granted only in limited amounts for industrial and artistic purposes.

Sales of Russian gold in London were reported again during the closing months of 1958, as they had been at this time in each of the five years beginning with 1953. The volume of such sales appears, however, to have been somewhat smaller than in 1957, when they amounted, according to a British official statement, to $200-million. As in earlier years, Russia was also reported to have sold gold in Zurich to acquire transferable sterling.

Private demand for gold continued throughout 1958 on a fairly extensive scale. In the Middle East and the Far East, the absorption of gold last year was apparently not as large as in 1957, but private interests in Western Europe seem to have purchased more gold in London than a year previous. In France, however, some $170-million was reportedly acquired by the authorities from the public in payment of subscriptions to a government loan the repayment of which is tied to the price of the 20-franc gold napoleon. An amnesty made it possible to French holders to sell foreign assets, even if previously undeclared, and to repatriate the proceeds by purchasing bar gold abroad and importing it to France—a procedure that made subscribing to the loan particularly attractive. At year end, France made bold reforms—devaluation, cuts in public spending (including subsidies), drastic revisions in the dangerous practice of "indexing" wages to prices, and the opening of trade to foreign competition. In 1959, a new "heavy franc." tied directly to gold, will be created. These measures, it is hoped, will lead to dishoarding of private gold and foreign assets, estimated at $9-billion.

Prices at which bar gold is traded directly for U.S. dollars or for convertible currencies (as in Montreal

. . . *"Another year has been added to silver's unusual history of price stability. Exports and consumption declined; the return of lend-lease silver was nearly accomplished."* p 129

Francis H. Wemple
Treasurer, Handy & Harman

or Zurich) deviated but little from the dollar equivalent of the London gold price. In markets where the local currency is strong although not formally convertible into dollars for residents (as in Brussels and Milan), prices were slightly above the London quotations. In Paris, the price at the end of December, following the 15% franc devaluation and announcement of the austere fiscal reforms, was slightly above $35 per fine oz. In other markets, however, the local currency gold prices were much higher; care, of course, must be taken not to read too much into these prices. They are quoted in inconvertible currencies and reflect basically monetary habits and conditions as well as expectations of local trends and developments. They also incorporate the cost of overcoming the hurdles that impede private flows of gold.

In the markets for gold coins, the price of the sovereign continued last year the gradual decline that began in 1957 after several years of rising tendency. The release by the U.K. of sovereigns for sale abroad—at current market prices and against dollars—tended to depress the price; newly minted sovereigns did not, however, attract so higb a premium as the older issues, partly because of a certain prejudice in Moslem countries against coins bearing a female head.

In France, the premium on the napoleon stood at the year end at about 12%, against 30% before the franc devaluation.

Gold disappearance into private hoards last year seems to have been about the same as in 1957. This may be inferred from the fact that during the first nine months of the year—latest period for which data were available before going to press—monetary gold stocks of central banks and governments increased by $570-million, while gold supply from new output and Russian sales was of the order of $900-million. Some two thirds of the new gold supply thus found its way into official stocks.

Gold outflow from the U.S. resulted in further additions to foreign official gold stocks. From mid-February, when the outflow began, through the end of the year, the U.S. gold stock declined by $2,251-million. The largest gold loss occurred during the second quarter (see chart); as the year passed, the gold outflow diminished.

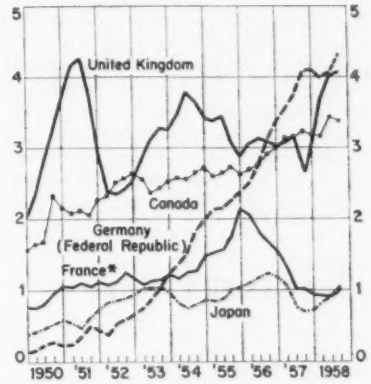
The chart also shows that gold flows have run both ways during the postwar years. The latest shift in U.S.

Dollar Equivalent of London Gold Price

(Monthly averages)

Gold and Dollar Holdings Selected Countries

(Billions of U.S. dollars)



*Excludes gold holdings of French Exchange Stabilization Fund.
Source: Federal Reserve Bulletin.

gold movements from the position of a net buyer to that of a net seller reflected, basically, a sharp reversal in the balance of payments with the U.K. and Continental Western Europe. At the time of the Suez crisis in late 1956 and at the high of the world-wide inflationary boom in 1957, most of these countries had lost gold and dollars to the U.S.; but with the passing of the Suez emergency and the restoration of financial stability, they put an end to excessive imports and capital flight. This in turn brought about a decline in U.S. merchandise exports from the unusually high levels of 1957 as well as some repatriation of foreign short-term funds. At the same time, U.S. merchandise imports were well maintained, and Government grants and loans as well as private capital outflow continued at high levels. The outcome was that the U.S. incurred a cash deficit of over $3-billion in its commercial and financial transactions with the rest of the world.

Not all currently acquired dollars, however, were used to purchase gold from the U.S., since foreign countries actually increased their dollar deposits and other short-term assets in this country. The gold outflow that occurred in 1958 cannot therefore be regarded as having been caused by a massive conversion of foreign-held dollars into gold. From February through October (latest available), Switzerland and the U.K. reduced, it is true, their dollar assets, but Canada, Germany, the Netherlands, and other countries continued to add to their dollar holdings.

The largest buyers of U.S. gold were the U.K. ($800-million during January-September—latest available), Belgium ($271-million), Italy ($293-million), the Netherlands ($151-million) and Switzerland ($215-million). These and other countries have traditionally kept the bulk of their reserves in the form of gold. They maintain the external value of their currencies by being ready to enter as buyers or sellers of U.S. dollars at the limits of a given range. They thus sell gold whenever they need to replenish their dollar balances to intervene in the exchange markets and they buy it whenever they have excess dollars.

By buying gold to help preserve the stability of the existing exchange rate structure, the U.S. has acquired large amounts during the last quarter of a century. Obviously, there would be no justification for having, at a fixed official price, bought this gold in the past if the U.S. were not also ready to sell it, at the same price, for the purpose of keeping stable the international value of the dollar. The interconvertibility of the dollar with gold in transactions with monetary authorities is an essential feature of the gold bullion standard as it functions today.

The U.S. gold position remains strong. Of the gold stock of $20.5-billion on Dec. 31, 1958, $11.8-billion was required as the 25% legal cover for Federal Reserve note and deposit liabilities (see chart). The actual ratio stood at 42.1% against 47.4% on Feb. 19, before the most recent gold outflow began.

Gold not required as cover for

currency—the excess Federal Reserve gold certificate reserve shown in the chart—stood on Dec. 31 at $8.1-billion, against $10.4-billion at the end of Jan. 1958. It was therefore less than the U.S. short-term liabilities to foreign countries on official as well as private account, which in October 1958, the latest date for which figures were available at this writing, amounted to $14.5-billion.

Of this amount, however, $5.8-billion was held by commercial banks, business firms and individuals largely as working balances and reserves against contractual obligations to Americans; such private holdings cannot be used to purchase gold from the U.S. unless sold to the central bank of the country concerned. The remaining $8.7-billion represented holdings of monetary authorities. Although such holdings are not legally convertible into gold, the U.S. has for almost a quarter of a century followed the practice of converting them into gold; a large part of these holdings consists, of course, of working balances to meet current or prospective payment requirements or to operate in exchange markets. Gold bought last year by foreign countries as a whole was purchased, as already noted, with currently acquired dollars, not by drawing down existing short-term dollar assets.

Foreign countries are also holding American stocks, bonds, and other securities, which were worth some $8-billion at the end of 1957. There was no evidence last year of any massive liquidation of portfolio investments by foreigners.

Foreign gold reserves, together with those of international financial institutions, stood at the end of 1958 at some $19-billion, about $3-billion more than a year previous. The U.S. thus still held somewhat more than one half of the Free World's monetary gold stock; the proportion had stood at 70% in September 1949, at the time of the world-wide currency devaluations.

Official gold stocks and official and private dollar holdings of foreign countries (excluding international institutions) were at the year end of the order of $33.4-billion—some $3.5-billion more than in December 1957. All principal trading countries except France shared in this rise (chart). While there was no general shortage of international reserves, there were, of course, individual countries that encountered payment difficulties and reserve deficiencies. In particular, many of the primary producing countries experienced renewed strains because of the fall in world prices of such commodities as coffee and copper; but inflationary spending remained the fundamental cause for the lack of a better balance.

The growing financial strength of Western European countries became even more visible in the last days of the year when all the principal currencies were made convertible for non-residents; the German mark was made convertible for residents as well in mid-January 1959. True, for several of these currencies the change merely formalized a convertibility into dollars that had already existed in practice; but this further step in the general process of enlarging the freedom of trade and payments was a development of great import. As a result, U.S. businessmen and exporters may gain from situations where external convertibility enables nonresidents to buy in the U.S. rather than in other markets. The ultimate benefits will depend partly on the further liberalizing of imports from the U.S., partly on the competitiveness of American prices in world markets.

For the U.S. itself, the principal conclusion that emerges from last year's gold developments is that there must be no complacency about the strength of the dollar. Americans as well as foreigners, are, of course, aware of the large real resources and high productivity of the American economy. Furthermore, inflationary pressures have been, and may well remain, weaker in the U.S. than in most foreign countries. Finally, although the U.S. is an international debtor on short-term account—its liabilities to foreigners greatly exceeding its banking claims on them—on long-term account it is an international creditor: our investments abroad exceed by about $35-billion the foreign investments made in the United States.

On balance, therefore, there are many elements of strength in the U.S. international position. There is no doubt, however, that the U.S., like other countries, is exposed to many economic and financial strains and stresses that may, among other things, tend to price American goods out of the world markets. Furthermore, the dollar is being used by much of the world as a currency in which to hold at least a part of monetary reserves and effect payments, and the U.S. gold price serves as anchor for other currencies. A flight from the dollar might be touched off if the idea gained ground that conditions were developing under which a rise in the dollar price of gold would appear inevitable. What counts, therefore, is the determination of the U.S. Government and of the Federal Reserve System to safeguard economic and monetary stability and thus prevent—by deeds, and not by words alone—the spread of doubts concerning the assured maintenance of the dollar price of gold•

Titanium

D. P. Eigo
Managing Editor

THE SURVIVORS of the Great Titanium Slump now find themselves in a better position than they have known since early 1957, and with hopeful prospects. Early last year, the industry's leaders were forecasting as much as a 10-year wait before titanium could hope to gain a non-military market to support industry capacity.

The decade-wide gap has been narrowed in both directions: Some productive capacity has been eliminated and some "stretched out," and some new uses for the metal will be increasing consumption.

The cutback has been painful. In March, Cramet Inc. stopped production of sponge and its plant at Chattanooga, Tenn. went to GSA which subsequently sold 1-million lb of tetrachloride and about 325 tons of sponge (off-grade) to private companies. No acceptable bid for the property has been received by the Government agency in its disposal efforts.

Stauffer Chemical Co., which operates a $TiCl_4$ plant at Niagara Falls, N. Y., closed two titanium metal pilot plants and sold another tetrachloride facility at Ashtabula, Ohio to Mallory-Sharon Metals Corp.

Allied Kennecott Titanium's planned refinery at Wilmington, N.C. has been subject to a lengthy stretch-out, and Dow Chemical's facilities have been shut down, but maintained on a standby basis.

Quebec Iron & Titanium Corp. suspended its electric furnace operations at Sorel on Oct. 1, but resumption is expected early this spring. Three new furnaces were added to the existing five and the first of the 20,000 kw capacity additions was operated continuously from December 1957 until the shutdown with "marked success." QIT reported a demand for

"Sorelmetal" low phosphorus iron in excess of capacity, and noted that demand held up well for sized ore for use as an aggregate in high density concrete for nuclear reactor installations and for coating submerged transmission lines.

> *"Magnesium consumption declined in 1958, but a return to 1957 levels is forecast for this year. A second primary producer has announced plans for a 6,000-ton plant." p 112*
>
> **J. Donald Hanawalt**
> Vice President, Dow Chemical Co.

Production of sponge metal was cut drastically during 1958 by the other producers (see chart). An estimated 4,500 short tons were produced in 1958 against 17,249 tons in 1957, according to Frank J. Cservenyak, chief, and John W. Stamper, commodity specialist, of the light metals branch, U.S. Bureau of Mines. Consumption, too, was down in 1958 (3,700 tons against the previous year's 8,221), but a part of that can be attributed to the recession. As one observer quipped, "Well, we've got production and consumption closer together than they've been in a long time!"

Toward year-end, consumption was showing some pickup; old markets showed new life and new markets seemed to be opening up. Commercial jet aircraft and conventional planes increased use by 50% over 1957, according to Thomas W. Lippert, director of marketing for Titanium Metals Corp. of America.

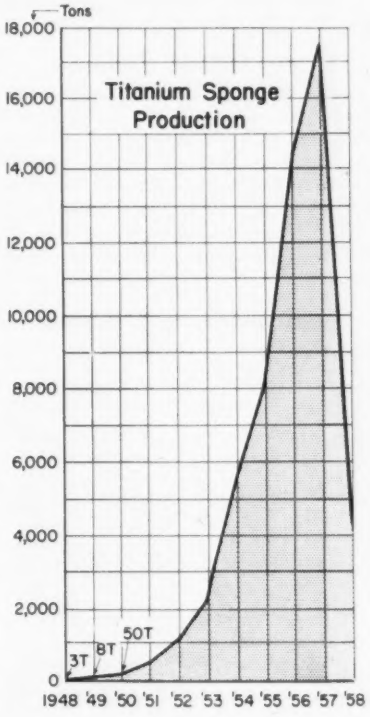
The Douglas DC-8 will contain more than one ton of titanium, Convair's new ship will use 2,500 lb, and the Lockheed *Electra* about 700 lb. In the military, the North American B-70 "chemical bomber" is expected to use "many tons" of the metal and the F108 fighter will also be a big user.

In Britain, according to Imperial Chemical Industries, Ltd., aircraft is still the largest user of titanium. In the U.S. the same ranking probably applies, with processing industries rapidly closing the gap as the market development effort increases.

Processing industry use increases steadily. Electrolytic, mineral, pulp and paper, food and chemical processes are consuming more and more of the metal in valves, piping, pump parts, vessels, screens and baskets. The biggest role now is one of replacement. So far, no plant has been designed originally with all the possible uses of titanium explored and exploited. Harvey Aluminum Inc. has formed an advisory group to work with manufacturers of processing equipment to stimulate new product applications. TMCA, du Pont and the other producers also maintain a technical consulting staff to promote market development.

Marine applications of titanium represent the newest potential. ICI notes the use of galvanic coupling of titanium to a metal from the platinum group to create an anode for cathodic protection of marine structures. Already, at Thames Haven, ICI notes, "a jetty comprising 15,000 sq ft of steel piling is being protected by four platinized titanium rods only 2 ft long and ⅞-in. in diameter. Lead-base alloys would have required 60 ft of 1¼ dia bar." Crucible Steel's Titanium Division (formerly Rem-Cru) has done work on titanium with a flashed surface of platinum for impressed current cathodic protection systems, like ICI Ltd. Harvey Aluminum cites uses of the metal in marine fuel tanks, sea water condensers, mufflers and exhaust pipes, sea water pumps and snorkel tubes.

Along with its contributions in the platinized anode field, ICI notes success with development of techniques for anodic polarization of titanium.



The metal, when used in non oxidizing acids, tends to lose its surface and corrode. ICI research has established that if the potential of the corroding titanium is raised, the metal becomes anodically polarized, the protective (oxidized) film reforms and corroding is reduced. The feasibility of employing the principle, ICI says "which amounts to continuous anodizing at a very low voltage and negligible power consumption, has been effectively demonstrated on small scale equipment incorporating heated tanks, piping, valves and pumps.

Price and research are the two main battlegrounds in titanium's fight for a prosperous industry. In the former, the industry again reduced its sponge metal and mill products prices against lowered demand and high costs. Sponge, which began the year at $2.25 per lb, ended it at $1.82. With each new price cut, the industry foresees proportionately greater application.

Industry study has been devoted to new application, improved product, and better technology. New Jersey Zinc, for instance, is continuing research on an electrolytic process for metal production. Two prototype cells have been constructed, the company says, and experiments are under way.

National Research Corp., which is developing fabrication processes, has perfected one for vacuum shape casting. The firm's metallurgical group "has succeeded in producing repeated, relatively large castings of complex shape which are non-porous and would appear suitable for aircraft use," says NRC.

ICI notes addition of three new vacuum melting furnaces with total capacity of more than 2,000 tons per year of one- and two-ton ingots. In the processing field, the British firm has produced lined vessels up to 45 ft long and 5 ft dia.

In the military, research has already improved welding techniques to permit manufacture of spherical titanium "bottles" which carry minus 320 deg F helium to the launching

site. In other research, the metal is being investigated as a material in missile thrust chambers and, of course, in more and more structural roles.

Du Pont made a significant contribution to technology with an expendable "rammed graphite" mold for titanium castings, which has cut costs and produces a product with qualities "similar to forged or rolled materials."

New alloys were announced by several of the leading producers, as well as improved castings, better surface quality on drawn tubes, tightened gages on sheet, development of an expanded sheet and, in the case of ICI, an extrusion method for fine wire. Alloys which move titanium's performance up into the 1400 deg F range were also announced.

Significantly, du Pont notes that, while the number of alloys is increasing, it appears most probable "that 90% of the process industry needs can be met by unalloyed grades."

The Government's role in titanium was lessened further. The Titanium Advisory Committee established in 1954 by ODM, was abolished June 11.

Mallory-Sharon, in a move indicative of the times, acquired the common stock of the Johnston & Funk Titanium Corp., fabricators of wire and rod, at Wooster, Ohio. TMCA, in late July, formed a new company, Continental Titanium Metals Corp., with Deutsche Edelstahlwerke (DEW), Germany's leading specialty steel firm. Mill products will be produced in West Germany.

In another foreign development, Japanese producers received orders for 240 tons of sponge from U.S. firms in late October. Previous shipments had been in the order of 10 to 20 tons. Commodity Credit Corp. has a 5-year contract to take 106 tpm of Japanese output from September 1957.

Outlook for titanium is dependent on a number of factors: What new alloys will be required? What other metals will enter competition? How quickly can the price of sponge and mill products be reduced further?

Whatever the answers, and in the case of the latter how favorable the answers, titanium is healthier than it has been in a long time, and its performance is gaining new recognition almost daily. Unfamiliarity, one of the big obstacles to its acceptance in the machine shop, is changing to familiarity, with improved machining, welding, less waste, and lowered costs•

Uranium

James W. Franklin
Associate Editor

THREE CONCLUSIONS may be drawn from current uranium information: One, the producers are in good shape, having a guaranteed market to 1963, and in many cases through 1966. Two, nuclear power will start showing economic advantage by 1963. Three, the period October-November seems to be the favorite time of the year for the AEC to make earth-shaking policy decisions.

In every phase of industry, 1958 was a good year. Domestic ore production rose from 3-million tons in 1957 to an estimated 5.1-million in 1958; concentrate went from 8,400 to 12,300 tons contained uranium; eight new mills went onstream; Anaconda may have another Jackpile (at least 7-million tons); and the AEC changed its policy to provide 2,500 tons of new concentrate production and to protect those who found the ore when the U. S. needed it.

In Canada the theme was the same —more concentrate production (13-,500 tons); the Rio Tinto organization moved in behind the whole U.S. and the rest of Canada as the world's third-ranking uranium producing community; and British Newfoundland discovered a 200,000 ton orebody, grading 0.6% U_3O_8, in Labrador.

The Congo still has 10 years of life at its present 850 tons of uranium per year and will build a refinery at Hoboken, Belgium, to treat part of the production. France is rapidly rising as an important producer. Portugal and Spain added to reserves. India found a large reserve of thorium and uranium. Australia saw Mary Kathleen come of age. South Africa gained the distinction of having a limit put on her purchases by the Combined Development Agency (6,-200 tons a year).

Momentum is building behind the drive toward economic nuclear power, thanks to the work at Chalk River, Calder Hall and in the U.S. By the end of 1958, the U.S. had eight reactors operating, including the king-size lab model at Shippingport which has operated since December 1957. England has operated three prototypes for two years and saved 400,-000 tons of coal—reason enough to push the construction of five large reactors. The Euratom Community sees nuclear power economic from the throw of the first breaker.

Canada says Candu "will do"—six mills or better. The Dresden, Ill. reactor will compete with coal-burners in the same area when it goes critical in 1962. India, Japan and Sweden have made similar claims for their projects.

By 1960 the world will have 1.5-million kw of nuclear power feeding into homes, offices and factories. In 1965 the sum will be 15.3-million kw. In 1960 the electric industry will need 1430 tons of natural uranium metal to inventory reactors and an additional 399 tons to refuel each year. By 1965, they'll need 4,500 tons for refueling purposes on an inventory of 16,500 tons.

Here is a country by country roundup of developments in 1958 and predictions for the future, based on response to questionnaires to the leading producing countries and the potential

Domestic Uranium Ore Production by States

(Fiscal 1956 through 1958)*

State	1956 (Tons)	1956 (Grade)	1957 (Tons)	1957 (Grade)	1958 (Tons)	1958 (Grade)
Arizona	213,647	0.25%	303,996	0.25%	**280,512**	**0.29%**
Colorado	392,386	0.31%	596,494	0.29%	**842,406**	**0.28%**
New Mexico	646,097	0.24%	1,218,196	0.25%	**1,345,888**	**0.22%**
Utah	772,148	0.31%	1,017,498	0.34%	**1,187,583**	**0.36%**
Wyoming	98,783	0.23%	147,925	0.23%	**518,865**	**0.22%**
Washington, Oregon, Nevada	9,714	0.29%	3,670	0.33%	**134,302**	**0.16%**
North-South Dakota	23,993	0.19%	68,538	0.17%	**47,709**	**0.19%**
Texas, California, Montana	2,883	0.20%	2,961	0.39%	**6,399**	**0.73%**
Total	2,159,111	0.28%	3,359,378	0.275%	**4,363,664**	**0.27%**

* Courtesy U.S. Atomic Energy Commission.

Uranium Ore Production Estimates*

Country	1958 (Tons per year or day as indicated)	1959
United States	**5,100,000**	7,000,000[1]
Canada	**42,000 tpd**	42,000 tpd[2]
Union of South Africa	**24,400,000**	24,700,000[3]
Australia	**575,000**	650,000[4]
The French Community	**386,500**	690,000[5]
Belgian Congo	**300,000**	300,000[6]
Northern Rhodesia	Unknown[7]	
India	Unknown[7]	
Portugal	Unknown[7]	

*All figures are official government estimates in response to E&MJ questionnaire unless specifically noted.

[1] U.S. grade is 0.27% U_3O_8. Latest report is 4,300,000 tons as of Nov. 1, 1958.
[2] Canadian capacity, not production. Two or three mills did not operate at full capacity in 1958.
[3] Union of South Africa reports grade at 0.6 lb per ton. Ore production to Oct. 31, 1958 was 20,181,042 tons.
[4] Australia reports grade at 0.2% U_3O_8. Actual production to Oct. 30, 1958 was 450,000 tons.
[5] The French Community reports grade at 0.2% U_3O_8. Actual production to Oct. 31, 1958 was 354,000 tons.
[6] No comment from the Belgian government on the Congo, but these figures are from the Euratom Community's latest official report (June, 1958). Shinkolobwe grade was reported at 0.3%.
[7] Northern Rhodesia, India and Portugal did not comment on ore production.

consumers. Information in the tables represents, for the most part, official opinions of the governments involved, and differs in many respects from that published in the literature.

Exploration Developments

U.S. exploration continued to decline in 1958. The industry was primarily occupied in developing existing reserves and preparing mines for production. Nevertheless, ore reserves increased from 78-million tons reported in January to 81.9-million tons in December 1958, largely as the result of work in the Gas Hills and Shirley Basin districts (Wyo.) and at Grants, N. M. The revised procurement policy (see below) is expected to stabilize the industry, and long-range exploration is expected to continue at a modest scale depending on individual company evaluations of the post 1966 market. Industry spokesmen say present reserves are 100-million tons.

Canada has noted very little exploration activity since 1955 as the result of the government's announcement that new contracts would not be considered after March 31, 1956.

Union of South Africa made no official comment, but the *South African Mining & Engineering Journal* conducted a survey of the potential production of concentrate for 1969. Here is a brief summary of their findings. Within 10 years these mills will be out of production—Daggafontein (300 tons), Vogelstruisbult (115 tons), East Camp d'Or (58), Luipaards Vlei (376), New Klerksdorp (44), and Babrosco (30)—a drop of 893 tons to a figure of 5,300 annual tons of concentrate.

The following mines are marginal producers at 12 shilling per ton milling cost (present estimated cost)—Doornfontein, Loraine, Welkom, President Brand, West Driefontein—and will drop out of the picture if the present concentrate price holds or falls. This would reduce potential by 110 tons to 5,190 annual tons.

Stillfontein and Western Reefs are marginal at present, but will not be in the future when they will be able to stop treating tailings and can handpick the ore to a slightly higher grade.

The *Journal* lists these as potential producers—Western Ultra Deep (220 tons), Buffelsfontein (a possible 125 tons), Hartebeestfontein (180 tons possible), Stillfontein (110 possible), Vaal Reefs (288 possible), Zandpan (580 tons), Dominion Reef (120 tons possible), Afrikander Lease (118 possible), New Klerkdorp (200). This would raise the figure to 6,590.

In the Orange Free State, Harmony could add 354, Virginia an additional 135 tons, Loraine 288. Freddies Consolidated will probably be closed, President Brand could add 102 tons, President Steyn 122, and the F. S. Saaiplaas 450. The potential in 10 years would be 7,730 tons of concentrate a year.

Nyasaland reports that the Geological Survey has located several deposits of radioactive materials and continues to look for others. All deposits, with one minor exception, proved to be refractory ores (betafite, davidite and uranium-pyrochlore). New Consolidated Goldfields investigate deposits at Tambani in the Southern Province and at Ilomba Hill in the extreme north of the Territory. In both cases, New Consolidated considers the deposits as primarily columbium producers with by-product uranium.

Germany is prospecting a deposit in Hesse. Total German ore reserves are only 100,000 tons grading 0.1% uranium oxide. Germany expects to produce 7 tons of concentrate in 1959 from about 6,000 tons of ore to be treated in a pilot plant.

Portugal has established a 15-tpy output pilot plant to test a find in Angola and another in Mozambique.

France, through Divisions Miniere du Commissariat a l'Energie Atomique, made new discoveries in Forez near Vichy, in Crouzille near Limoges and in Vendee near Nantes. Interesting occurrences have been made in Herault and in the Maritime Alps.

Private companies obtained good results in Bretagne and in the Massif-Central, from which production is already being taken.

In Mounana, in Gabon (French Equatorial Africa) an important dis-

. . . "Consumption of thorium in magnesium-thorium alloys was expected to exceed 1957 alloy consumption by 25%." p 101

James Paone
Commodity Specialist, U.S. Bureau of Mines

Uranium Concentrate Production Estimates*

Country	1958 Tons	1958 Grade	1959 Tons	1959 Grade
United States	12,300	80%	18,000	80%[1]
Canada	13,500	75%	15,000	75%[2]
Union of South Africa	6,170		6,340[3]	
Australia	700	70%	1,400	70%[4]
The French Community				
Metropolitan France	815	69%	1,300	70%[5]
Madagascar	540	15.6%	570	15%[5]
Belgian Congo	850	70%	850	70%[6]
Northern Rhodesia	44	100%	44	100%[7]
India	Unknown[8]			
Portugal	Unknown[8]			
Sweden	10		10[9]	
West Germany			7	70%

*All figures are official government estimates in response to E&MJ questionnaire unless specifically noted.

[1] U.S. reports actual production at 10,000 tons on Nov. 1, 1958. Figures above are subject to modification depending upon completion dates of new mills, production schedules of various mills just coming into production and contracts which are under negotiation. Price paid to domestic producer was $9.66 per lb in fiscal 1958 and will be even lower in fiscal 1959—$9.24. Price paid to foreign producers will average $10.92 per lb in fiscal 1958, and will be down to $10.77 in fiscal 1959. Foreign producers will get a $1.53 per lb more than domestic producers in fiscal 1959. The U.S. buys from Canada on a bilateral agreement, and from the rest through the Combined Development Agency. U. S. reports contained uranium oxide.

[2] Canadian production is sold to the U.S. on a bilateral agreement which expires March 31, 1963. Price is $8 per lb. U.S. has option to buy during the 1963-1966 period and must notify Canada by 1961 what its intentions are. Prediction is that they will buy. Deliveries to the U.S. in 1958 are estimated at 12,610 tons of concenrate, according to the AEC. Canada has contract with U.K. to deliver $215-million worth of uranium products by 1963.

[3] Union of South Africa reports actual production to Oct. 31, 1958 at 5,198 tons. Average recovery in 1958 will be about 0.51 lb per ton; in 1959, 0.52 per lb ton. The Union has a contract with the Combined Development Agency for a maximum of 6,200 tons a year. Contracts begin to expire in 1965 and all will be finished by 1969. The South African Mining & Engineering Journal calculates that potential production by 1969 will be 7,730 tons a year.

[4] Australia reports actual production to Oct. 30, 1958 at 500 tons.

[5] The French Community reports Metropolitan production at 615 tons to Oct. 31, 1958; and Madagascar's at 420 tons.

[6] Belgian Congo figures are not official, but are from Euratom Community's June, 1958 report. U.S. buys 75% of the Congo production through Combined Development Agency. Congo figures are contained uranium.

[7] Northern Rhodesia reports actual production to Oct. 31, 1958 at 36.62 tons.

[8] India has been collecting uranium residue from a thorium plant since 1955. A plant is being considered to treat 500 tpd of uranium ore. Portugal has maintained about the same production as past year, but amount is not known.

[9] Sweden operated a 10-tpy pilot plant on shale (see ore reserves).

1958 Uranium Ore Reserve Estimates*

Country	Millions of tons	Grade (U_3O_8)
United States	81.9	0.27%[1]
Canada	320	2.4 lb[2]
Union of South Africa	55.9	0.565 lb[3]
	21.6	0.468 lb[3]
Australia	10.0	0.15%
The French Community		
Metropolitan France	0.2	0.1%[4]
Madagascar	only 2,500 tons	15.0%
Belgian Congo	2.0	0.3%[5]
Northern Rhodesia	Unknown[6]	
India	15.1	0.3%[7]
Portugal	Unknown	
Sweden	2,600	0.038%[8]
Italy	3.0	0.2%[9]
West Germany	0.1	0.1%

*All figures are official government estimates in response to E&MJ questionnaire unless specifically noted.

[1] U.S. industry spokesmen say figure should be 100-million tons, not 81.9; but the AEC includes only economic, amenable ores at present concentrate price.

[2] Canadian reserves are for Blind River area only. Government states that the other four producing areas have geological characteristics which do not permit reserve estimation much ahead of mining. The newly discovered Labrador deposit (see "watch for" section of the lead article in this issue) contains an estimated 200,000 tons, 0.66% U_3O_8.

[3] Union of South Africa has over 1.1-billion tons containing 370,000 tons of uranium. However, the latest official figures show 55.9-million tons fully developed or blocked out for stoping, and an additional 21,626,000 tons in safety pillars, dumps and tailing ponds.

[4] Metropolitan France has only 250 tons contained uranium with another 50- to 100,000 tons possible or potential according to the June Euratom Community report.

[5] According to Euratom, Shinkolobwe in the Belgian Congo will run out of ore within 10 years unless other deposits are discovered. Euratom estimate is of Jan. 1, 1958. Belgian government declined to comment. Grade is U not U_3O_8.

[6] Northern Rhodesia considers the data classified.

[7] India has never published reserve estimates. This figure is our own based on Travancore and the newly discovered Bihar deposit. In "Thorium", E&MJ notes Travancore at about 1.8-million tons, 0.35% U_3O_8. The Bihar deposit, according to the 1957-1958 Department of Atomic Energy (Government of India) report, contains about 13.1-million tons, 0.3% U_3O_8.

[8] Sweden has 1-million tons contained uranium in shale. A pilot plant has been producing about 10 tpy of concentrate, and a 900,000-tpy mine and mill are being developed at Vastergotland to produce 120 tpy of concentrate. Such a deposit would be uneconomic anywhere else, but will satisfy Sweden's uranium needs from 1962 (when it is onstream) to 1965.

[9] Italy's data is not official, but is from Euratom report. Official reserves are 150,000 tons, 0.2% proven; 1.5-million, 0.15% probable; and 6.5-million tons, 0.1% possible.

U. S. Added Eight New Mills

	Company	Capacity (tpd)
Gunnison, Colo.	Gunnison Mining Co.	200
Fremont County, Wyo.	Lucky Mc Uranium Corp.	750
Grants, N. M.	Homestake-New-Mexico Partners	750
Grants, N. M.	Homestake-Sapin Partners	1,500
Grants, N. M.	Phillips Petroleum Co.	1,725
Grants, N. M.	Kermac Nuclear Fuels Corp.	3,300
Lakeview, Ore.	Lakeview Mining Co.	210
Riverton, Wyo.	Fremont Minerals, Inc.	500

covery was made in 1957 and is being explored and developed, and reserves are being augmented.

In Italy, mineralization of some importance has been found in Piemonte, Val d'Aosta, Lomardia, Trentino-Alto Adige, Calabria and Sardegna. However underground research has been carried out in only two areas. In the Permian schist of the Maritime and Cottian Alps 100,000 tons, 0.15% grade have been proven, 500,000 tons, 0.15% are probable and 1.5-million tons listed as possible. Definite estimates of reserves will be made in 1959, and by mid-1960, production is expected to yield 65 annual tons of metal.

In the Permian sandstone of Val Gardena in the Central Eastern Alps 50,000 tons of 0.2% have been proven, 1.0-million of 0.15% are listed as probable and another 5-million as possible at 0.1% U_3O_8. By 1960-61, sufficient reserves will be developed to make mining possible. By 1961, production will be at a 160-tpy metal rate, expandable as needs and new reserves arise.

Private companies searching for uranium in addition to the government body CNRN, were Montecatini, Societa Minerali Radioattivi Energia Nucleare, Societa Mineraria e Chimica per l'Uranio, Fiat and Edison.

Mine and Mill Developments

The U.S. started production of four large mines in the Ambrosia Lake district near Grants, N. M. in one month during the year to bring the total from the district to 95,000 tons per month. Shaft sinking and development were under way at eight other mines.

Eight mills went onstream (see table) to bring the total production capacity to 21,065 tpd. The Cotter Corp. (see Front Range discussion below) started up a 50-tpd pilot plant at Canyon City, Colo. The U.S. has 23 mills operating; taking into account the closing of the Naturita mill, transferring capacity to the Durango mill by Vanadium Corp. of America and the closing of the old Rifle mill by Union Carbide.

In the fiscal year ending June 30, 1958, domestic production of uraranium concentrate was 10,111 tons, up 35% in a year. Of the total, 150 tons came from three Florida pebble phosphate pilot plants, from the Idaho euxenite processing plant, and from reprocessing of refinery residues at Canonsburg, Pa. Production for fiscal 1959 will be from 14- to 15,000 annual tons. By mid-1960, domestic production should hit 20,000 annual tons of concentrate valued at $320- to $360-million.

U. S. Ore Reserves by State—June, 1958

State	Millions of tons	Grade U_3O_8
New Mexico	52.8	0.26%
Wyoming	11.1	0.30%
Utah	5.1	0.36%
Colorado	3.7	0.29%
Arizona	1.4	0.32%
Washington, Oregon and Nevada	2.6	0.23%
North and South Dakota	0.6	0.26%
Texas, California, Montana, Idaho and Alaska	1.8	0.23%
Total	78.5	0.27%
Total end of 1958	81.9	0.27%

The Monticello buying station is now the only one open. Once again there was opinion that the Commission wanted to close the Government-owned Monticello mill, where ore receipts have fallen to 3,000 tons a month and the stockpile has dwindled to 100,000 tons. AEC will probably close Monticello before 1960 but no definite decision has been made. Uranium Reduction, at nearby Moab, could handle production in the area. During the year, Uranium Reduction added a $3-million alkaline leach circuit to the present acid plant which will allow Moab to treat a wider range of ore types.

In April 1958 the AEC announced, to the joy of those domestic miners yet without shipping contracts, that the U.S. would permit an expansion of 3,300 tpd ore in new mills or expanded mills to add 2,500 ton to the annual concentrate production. The expansion was to be allotted as follows:

Area	Tons
Wyoming	1,700
Texas	600
North and South Dakota	600
Front Range, Colorado	200
Austin, Nevada	200

By the end of April it was already known who had the best chances to get mill contracts for the areas. It was late summer before the first contract was signed—that to expand Texas Zinc Minerals custom ore milling capacity from 4,600 to 13,000 tons a month. As we went to press none of the other contracts, reportedly negotiated and approved, had yet been signed.

At a meeting held in November with industry members of the Uranium Institute of America to explain the November cut-off announcement, Allen Jones, AEC Grand Junction manager, said that it constitutes a cut-off of any Commission guarantee of any kind for future ore discoveries. The Commission has begun the complicated project of revamping all mill contracts through the year 1966, and it may take as long as a year in some areas. The Commission is now negotiating for an extension and distribution of the ore market for independent producers in the Moab area (perhaps to hasten the closing date for Monticello).

Under the new long-term contracts with the millers, AEC will allot mining capacity and mine deliveries in pounds of contained U_3O_8 (for the independents as well as the miller's captive mines) over a reasonable period of years, depending on the individual miner's ore reserve estimates and his present or reasonable mining rate).

The miner may not get to ship as much as he would like, but at least he will know how much he is allowed to ship each year (how he ships will be determined by the miller and miner).

A mine with an allotment can ship to the mill as long as it produces an amenable grade. Officially, a new deposit or orebody cannot be opened (there will be exceptions). Should a miner run out of ore, his mill quota will go back to the Commission to be reallotted (if needed). The number of shippers to a mill may vary from two to 40. If a mill wants to sell its alotted concentrate to the Commission, it must buy the allotted ore from the miner.

The Commission will still continue to be bound by Circular 5 until 1962.

If a miner or miller goes out and finds a new deposit, regardless how amenable, and even though a miller would like to buy it, the AEC will not purchase the concentrate from that orebody. But a miner or miller may produce concentrate from an unallotted orebody for direct commercial sale in accordance with his Commission license, and this material shall not be part of the miner or millers ore allotment.

After first viewing the AEC's 1962 to 1966 uranium concentrate purchase program modification with considerable alarm, the Uranium Institute took the time to analyze the program and saw a decided benefit to the industry.

1. The new program will create a market for several million tons more

uranium ore than the former program. Reserves insured by the AEC have an estimated $2.5-billion value.

2. It legally binds the post-1962 price at $8 per/lb contained U_3O_8.

3. It provides a sound basis for completing the expansion program that has been hanging fire for almost a year.

4. The AEC buying program has been inserted in the *Federal Register*, which makes the program legally binding—former policy was not.

5. It insures that the U.S. domestic uranium market will be in the $300-million class for the next eight years at least.

The AEC policy modification says that purchase price will be $8 per/lb contained in acceptable concentrates. It will guarantee purchase of concentrate produced through Dec. 31, 1966. AEC may announce new contracts or amendments to existing contracts to suit needs of an area from ore reserves developed prior to Nov. 1, 1957.

The Commission action guards against overproduction and protects those that have developed ore reserves prior to the November date. It is not due to any reduction in the needs of U.S. uranium or in potential commercial requirements, said Mr. Jones.

Canada has 19 mills treating captive ores, for the most part, with total milling capacity at 42,000 tpd. Production was somewhat less in 1958 as some mills did not operate at full capacity throughout the year. One new mill went onstream in 1958—Canadian Dyno at Bancroft (1,000 tpd). Contracts expire March 31, 1962 for some mills and on March 31, 1963 for the rest. Production in 1956 was 2,279 tons of concentrate; in 1957 the figure was 6,732; and in 1958 the rate was 15,000 tpy, but the amount was somewhat less. Probable figure for production will be in excess of 13,500 tons—based upon Canada's deliveries of 12,610 tons of concentrate to the U.S. in 1958.

Official Canadian reserves are listed in the table. Mining officials say the figure is larger—at least 375-million tons in Blind River alone, which holds 90% of Canada's reserves. Blind River now has 11 mines and mills treating 34,800 tpd for 80% of Canadian production—$250-million in one camp. Consolidated Denison has the largest capacity of any mine and mill in the world at 6,000 tpd. Her reserves are sufficient for the next 50 to 60 years at present mining rate—137-million tons.

Pronto Uranium, the first to go into production in Blind River, began paying dividends to shareholders in 1958. Pronto raised mill capacity to 1,500 tpd and is deepening the shaft another 500 ft. Reserves are 3.1-million tons.

Stanrock Uranium lists official reserves at 8.5-million with potential reserves running to 20-million tons. The Northspan group, now under the Rio Tinto banner, operates three mines and mills with 9,000 tpd capacity—the third largest producing community in the world, followed by the rest of Canada and South Africa.

Port Radium reserves are less than 130,000 tons, 0.58% and mill capacity is 200 tpd. The mine will be closed by 1961.

Rayrock Uranium raised mill capacity to 185 tpd in 1958, but operates at 130 to 150 tpd due to limited ore reserves.

Gunnar Uranium's mill capacity was raised to 2,000 tpd. Lorado increased to 750 tpd. Eldorado's mill can treat 2,000 tpd.

In the Bancroft, Ont. camp, Faraday has a rated mill capacity of 1,400 tpd to handle her own production from a 1.7-million ton orebody and another 200 tpd from Greyhawk Uranium. During 1958, Faraday averaged 1,350 tpd with 150 tpd from Greyhawk. Bicroft has 1,400 tpd, treats about 1,100 tpd. Bicroft reserves are about 5-million tons. Canadian Dyno went onstream at 1,000 tpd on 2-million ton orebody.

In November, *Precambrian* published an excellent review of the entire Canadian uranium program.

Eldorado produced an average of 330 tons per month of uranium oxide at the Port Hope refinery in 1958, treating concentrates from Port Radium, Beaverlodge camp, Pronto, Algom and Gunnar. Eldorado operates a metal refinery and produces ceramic oxide pellets of uranium dioxide. Fuel elements needed for the Canadian reactor program are fabricated by American Machine & Foundry Atomics (Canada) Ltd.

In the Union of South Africa an agreement was reached with the Combined Development Agency (U.S. and U.K.) on the maximum amount which the agency would agree to buy in any year—6,200 tons of concentrate. The Combined Development Agency buys from the Union, the Congo, Australia and Portugal. In 1957, the Union sold 5,709 tons to the agency. South African contracts begin to expire in 1965 and all will be ended within the following two or three years. (See "exploration" for more details about future expansion possibilities.)

Australia. Open cut mining started on deposits of the Mary Kathleen, where the mill went onstream in late summer at half capacity (1,000 tpy design). Ore reserves are 6.6-million tons, 0.1%. At Rum Jungle, White's and Dyson's orebodies were mined out and work shifted to other deposits. Stockpile at the mill is 372,800 tons, sufficient for 3½ years of operation. A new high-grade deposit was discovered nearby, but the size has not been determined as yet. A jigged bed resin-in-pulp process is being tried in the pilot plant and if successful will be used.

Mining commenced at El Sherana. Solvent extraction is being used for the first time in Australia at Hercules and at Rockhole Creek (in Northern Territory). South Alligator will have the pilot plant onstream in 1959 to produce about 100 tons of concentrate. Reserves are 10,000 tons, 1% ore. The contract with the Australian AEC is for £A1,150,000.

Mary Kathleen's mill will use pH control to 1.9 at 40 deg C to selectively leach uranium from the phosphatic-siliceous ore. Port Pirie has decided to handle refractory davidite by leaching at 60 to 65% solids as described in "Metal & Mineral Processing" review in this issue.

Metropolitan France has two mills capable of treating 180,000 metric tpy ore. One is located at Ecarpiere with 150,000 metric tpy capacity. The other is at Geugnon with 30,000 metric tpy capacity. Two mills are to be constructed before the end of 1959, which will raise the French capacity to 350,000 metric typ. One will be at Bessines with 200,000 metric ton capacity, the other will double Ecarpiere's capacity to 300,000 metric tpy.

By 1960, Bessines will have a mill of 400,000 metric tpy size, and another mill will be onstream at Forez with 250,000 tpy capacity. Total treating capacity when all mills are onstream will be 1,180,000 metric tpy yielding about 1,500 metric tpy concentrate. French planning for both Metropolitan and Overseas Territories is for 1,000 metric tpy output by 1961 and 3,000 metric tpy by 1975. The figures are sufficient to cover France's nuclear power needs. France is capable of refining her own concentrate as well as fabricating fuel elements.

Metal refining capacity at Bouchet is 500 metric tpy metal and 300 metric tons of thorium salts. A new plant is under construction at Malvezy near Narbonne, which will produce 1,000 metric tpy metal from

concentrates and used fuel elements. France's metal production plans in metric tons for the next few years are —500 (1958) 2,000 (1961) 2,500 (1970) and 3,000 (1975).

The Belgian Congo still continues to produce concentrate at the same rate that has prevailed over the past few years, about 1,000 tpy. Reserves are sufficient for about 10 more years of operation—2 million tons, 0.3% U.

The mill has capacity for 300,000 tpy input. The U.S. buys 75% of the Congo production through the Combined Development Agency. Union Miniere du Haut Katanga operates a 425 typ UO_2 plant at Hoboken which also turns out 50 tpy of metal. Union Miniere will add to the refinery to treat part of the Shinkolobwe concentrate, which it will then deliver to the Combined Development Agency.

Euratom Program. Euratom estimates its uranium metal needs at 24,000 tons to feed 7.5-milion kwe by 1967. An estimated 2,500 tons of metal a year will be needed for this installation after that date—which is about what Belgium and France combined will be averaging each year during the 1958 to 1967 period. Of the 24,000 tons needed by 1967, Belgium and France will be able to produce about 15,000 tons during the same period.

The Federal Republic of West Germany is building two ore treatment plants, one in Rhenanie-Palatinat of 50-tpd feed capacity and another in Wolsendorf, Bavaria which will be just a pilot plant. By 1960, the Bavarian deposit is expected to yield 50 tpy of concentrate. Another deposit at Hesse is being prospected. Estimates of present concentrate production is 7 tons of 70% grade. Germany has plans under consideration for a metal refinery, and plans to have 500,000 kw installed nuclear power by 1965.

Italy. Spinetta Marengo, Alexandria, is operating a pilot plant, as is S. Donato Milanese, Milan. Some reactor-grade metal is being produced by CNRN in a pilot plant of 40 kg per day capacity.

Sweden produced about 10 tons of concentrate in 1958 from a pilot plant at Kvarntop. Reserves in shale, while low-grade, are huge—2.6-billion tons of 0.038% U_3O_8. Such low-grade ore would be uneconomic anywhere else in the world, but Sweden intends to mine and mill it. An ore treatment plant is being built at Ranstad in the western province of Vastergotland to mine and mill 900,000 tpy, and produce 120 tpy of concentrate by 1962, sufficient for Sweden's nuclear power needs until 1965.

Estimated Installed Nuclear Generated Power by Country

(Millions of kilowatts)

	1960	1965	1970
United States	0.4	2.5	10*
United Kingdom	0.5	5.5	10
Euratom Community	0.2	4	10[1]
Canada		0.2	1
Finland	0.1	0.2	0.6
Sweden	0.1	0.1	0.5
Italy	0.1	0.8	
Spain		0.1	
Switzerland		0.1	
India		1.0	
Japan	0.1	0.6	4.5
Cuba		0.2	
Total	1.5	15.3	36.6

* U. S. will have 5- to 6-million by 1967.

1. France plans for 8-million by 1975 (0.85-million by 1965). Belgian planning is for 0.3-million by 1963, 0.55 to 0.6 by 1967, and 1.2-million by 1975. Germany for 0.5-million by 1965.

Northern Rhodesia considers reserves and the mining rate confidential, but reports concentrate production at 44 tons in 1958. The same is predicted for 1959. The mill is at Mindola where gravity, flotation and leaching are combined to produce a concentrate. Mining is undergorund by cut-and-fill stoping.

India has operated the thorium mining and milling project at Alwaye, run by Indian Rare Earths (Pvt.) Ltd., since 1952. The plant produces rare earths, trisodium phosphate, and a cake containing thorium and uranium. Cake is refined at a plant in Trombay into a very pure thorium and uranium salts. The plant has been onstream since 1955.

A proposal to set up a 500-tpd uranium ore treatment plant to produce a chemical concentrate is being considered. India will build a heavy water plant and plans to build at least one reactor as soon as possible. When operating data is forthcoming on the use of thorium in a reactor, India intends to swing over to thorium powered reactors. This will probably come in 1975. India has tremendous thorium reserves—in excess of 680,000 tons contained thorium.

Competition. There will be no problem between nations or uranium producing areas until after 1966. Thorium is still in the picture, but 10 to 15 years away. Fusion is not considered a threat in our time.

There were a few complaints that the U.S. is taking unfair advantage of the other producing nations in the quest for uranium markets through too generous grants of time, money, reactors and fuel, but most nations applaud the U.S.'s uranium buying and reactor development program as the necessary means toward a common goal—competitive nuclear power.

Outlook. For the most part, the miner and the miller have a guaranteed market through 1966. As more and more nations throw more effort behind the drive toward nuclear energy, our estimates of time, uranium consumption and installed power will probably rise above the present low figures.

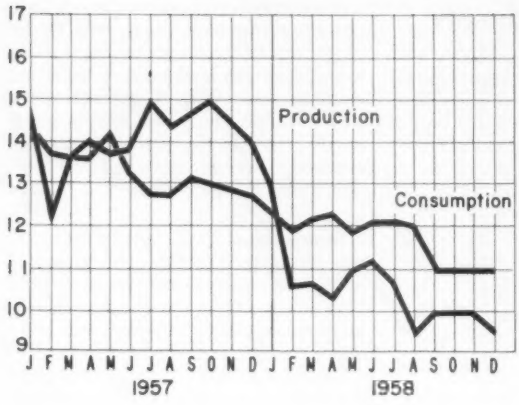
In many areas of the world, nuclear power is now competitive with fossil-fuel burners of the same size. A rumor was circulated at Geneva to the effect that the British were dissatisfied with results obtained to date and were seriously considering going back to coal. They replied to a query promptly, as follows, "We have no intentions of giving up our nuclear program and are in no way unhappy about the nuclear power costs, which in our particular case should break level with coal power by about 1962. Even in the stations now being built the costs are only marginally higher than for the very best conventional stations"•

. . . *"Last year showed the lowest mine production of lead for any year since around the turn of the century. Quota imposition and improved prices helped the market move up a little in the fall. New uses are extremely interesting."* *p 110*

Robert L. Ziegfeld
Secretary
Lead Industries Association

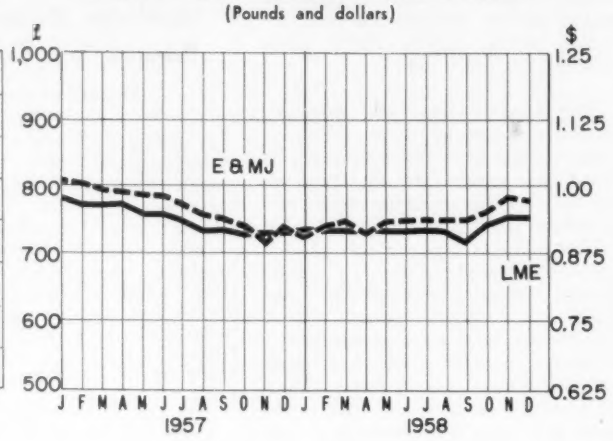
World Tin Production and Use

(Thousands of long tons)



E&MJ and London Tin Prices

(Pounds and dollars)



Tin

J. R. O'Connell Jr.
Assistant Market Editor

THE INTERNATIONAL TIN AGREEMENT was hit with a barrage of economic catastrophes in 1958, but to the wonder of many observers, managed to survive the year. The organization has proved its staying power against great odds and has convinced more than one skeptic that she means business and will not buckle under pressure.

The American recession, Russian exports, drastic export quotas and lack of cash to support the ITA floor level were major blows sustained by ITC member nations during the past year. For the second year running, there were no U.S. stockpile purchases.

Despite the recession here, Russian exports, estimated at 9,300 tons in 1957, were the major threat to world tin markets as 1958 began. Beginning Dec. 15, 1957 ITA slapped on quotas amounting to a cut of 28½% of established exports, which later ballooned to 40% when the initial period was extended from Mar. 15 to Mar. 31, 1958.

Russian tin was accepted for trading on the London Metal Exchange commencing Feb. 6, 1958. Many felt it was preferable to have tin removed to the buffer stock than be tossed on the physical markets of Europe. Acceptance was suspended late in February when inferior metal began to turn up. Early in March the pool manager was again buying upgraded and rebranded Russian metal.

There was no let up in Russian exports during 1958 until the last quarter. The total shipped is estimated at 18,000 tons. Cries of economic warfare echoed across the market. Why else would Russia, which exported only 1,500 tons in 1956, step up its exports so greatly was the question asked.

A more rational view, reportedly supported by U.S. Government observers, was that the Russian economic surge had pushed its tin industry ahead to the point it was ready to take a position as a world supplier. During the year a Russian government official was quoted saying USSR output exceeded that of Malaya. Undoubtedly the Russians were also committed to take some quantities of Chinese metal, unacceptable in many of the Free World markets. The Russian need for foreign currency to pay for imports was also considered.

Although the Russians probably were not averse to demonstrating their ability to creat economic chaos, it is unlikely they would single out the major tin-producing countries of the world. These nations fall into the "under-developed" category — countries whose people and governments are the prime targets of the international Communist movement.

Intentional or not, their exports, coupled with the U.S. recession, kept the market and the ITA in a near state of collapse during 1958. Quotas for the second period, Mar. 31 to June 30, 1958, were continued at 40%—23,000 tons of allowable exports for the six member producers. The same quotas prevailed during the third period, June 30 to Sept. 30.

While producing nations struggled with overburdening cutbacks, Russian tin flowed to London where the buffer pool manager, supporting the £730 floor, was obliged to purchase it.

Early in the year ITA rallied and hit back with a special fund contributed by members, whose amount was never to be made public, available to the manager when his cash ran out. The fund was not restricted to regulations of the ITA charter. By summer it had become obvious that ITA would not be able to continue under prevailing conditions.

In June ITC extended a formal invitation to Russia to become a member nation. After some deliberation Russia announced that she would not become an active member, but desired admittance as an "observer." The Russian suggestion was turned down. The year ended on a positive note when Russia indicated she was willing to cooperate with ITC. Rumors that she would control her exports were finally confirmed in January. The amount agreed on was expected to be 13,500 tons, China included.

The first break came late in the summer when the United Kingdom applied import quotas, effective Aug. 30, 1958. The Netherlands and Denmark followed. The quotas, maintained to the present, limit Russian and Chinese imports to 750 tons of unwrought tin and tin alloys per quarter. The action removed immediate pressure from the pool manager, but was considered bearish in some quarters. Many felt Russian tin would end up in physical European markets at bargain rates—enabling buyers to sell back to the pool at higher support levels.

Market intrigue reached a climax

on Sept. 18, 1958 when ITC, risking a collapse, withdrew support of the market with the simple statement, "The buffer stock manager of the ITC has withdrawn for the time being his support of the cash price of £730." The manager had apparently reached the end of his funds. He affirmed his belief in ITA and said quotas would remain unchanged. Trading on the LME was suspended during the first call. When resumed, the market had fallen £90 to £640, but jumped back up immediately. By early October it regained the £730 level and to the present has remained well above it.

Quotas for the last quarter were tightened. They were set at 20,000 tons (48%), compared with 23,000 tons the previous period. Quotas of 48% have been carried over through the first quarter of 1959.

The ITC met eight times during 1958, in January, March, April, June (Paris), July, September, November and December. The first meeting in 1959 is set for Feb. 17. The pool held, exclusive of special fund purchases, 15,300 long tons on Dec. 31, 1957; 22,440 tons on Mar. 31, 1958; and 23,300 tons on June 30, 1958. Korean membership was ratified in June.

During most of the year the pool manager was authorized to sell at the £780 level, but the market failed to reach that point. In addition to the buffer stock, it is estimated that the pool also held about 4,000 to 5,000 tons of metal purchased with the special fund. Some market observers believe a portion of this tonnage may already have been liquidated through gradual sales. In June ITC had stated that it had no intention of selling metal under current market conditions, but since then the Russian threat has been temporarily relieved.

Expulsion of the Dutch from the Indonesian tin industry was completed in 1958. Indonesia immediately began shipments of ore to the lone U.S. smelter, situated in Texas City and owned by the Wah Chang Corp. No tin ore had been smelted there since January 1957, at which time the plant was sold by the U.S. Government. The ore is smelted on toll and sold as Banka tin (Grade A) through a New York sales agent. The first arrival of concentrates, 1,422 tons, reached the U.S. in March.

All of Indonesia's ore was shipped to The Netherlands in 1957, but prior to then, about 50% was shipped to Texas City with the product going to the U.S. stockpile. Sales representatives here say the ideal is still 50-50, but sharp bidding from European smelters probably threw this ratio out of balance in 1958. Strict quarterly quotas and lengthy shipping periods resulted in a few large shipments of concentrates to the U.S. rather than constant arrivals. Published figures, though inadequate, indicated that arrivals were less frequent in the second half of the year. In November it was announced that a large London firm would handle sales and smelting of Indonesian ores formerly serviced in The Netherlands.

The significance of Texas City output is one of switching markets. When concentrates were smelted in the Netherlands, most of the metal was retained for sale in Europe. The U.S. becomes a prime market for all tin produced at Texas City. The Wah Chang product has been well received, and it along with other imported Grade A metals, available at discounts, has in many cases displaced Straits quality metal. Ordinarily displaced metal from U.S. markets would find abandoned European markets, but with Chinese metal, and previously Russian, available, losses may not always be restored.

The negative aspect of the ITA has shown up primarily in regard to Malaya. Buyers, particularly in the recession-ridden U.S., have not taken artificial support of the market well. Weakened business activity and lower prices of other metals only highlighted this. Consumers were apparently indignant when fourth quarter export quotas were tightened despite a firming market.

Malaya, which has sacrificed the most in the way of cutbacks, has seen her Straits product lose a good deal of ground to Grade A brands selling for ¾c to 1½c less. Many tin platers, for years dedicated to Straits metal, apparently made the break during the recession, at which time supported prices stayed up. As it stands, the country with the largest stake in ITA will unquestionably be the one to lose the most permanent ground. Meanwhile Japan, a major Malayan market, has been reported sampling discounted Chinese metal.

Primary Tin Statistics

(Long tons)

	1958	1957
World mine output	(c) **127,000**	173,500
World consumption	(c) **143,000**	157,000
World stocks:		
Gov'ts included	(a) **395,000**	410,000
Gov'ts excluded	(b) **70,000**	87,000
U. S. consumption	**45,000**	54,429
U. S. import (pig)	**42,000**	56,107
U. S. output (pig) at Texas smelter	**5,000**	1,565
Price, av., N. Y. prompt	**95.127c**	96.261c
Price, av., London, cash	**£735,035**	£754.828

(a) This estimate was arrived at by adding to the International Tin Study Group figure for the end of 1947 of 135,000 tons, the excess output over consumption each year. (b) I.T.S.G. figure. (c) Excludes USSR, includes Red China.

World production in 1958 has been estimated at 127,000 long tons. This figure includes Red China and producing countries not belonging to ITC. It excludes Russian output. The figure is broken down into 93,000 tons of permissible exports by ITA members; 12,000 tons from non-member countries, 12,000 tons from Red China and 10,000 tons production held in stock by ITA members. This last figure may be too high, and Chinese production may well be too low.

World consumption is estimated at 143,000, including about 6,000 tons by Red China. In the case of China, we are assuming about half her output was exported. Any additional output by China probably ended up in Russia.

Russian exports are estimated at 18,000 tons. For conjectural purposes most of these may be canceled by buffer pool and special fund purchases.

Excluding the 10,000 tons credited to ITA producer stocks, available metal is assumed to have been about 117,000 tons. Consumption would thus show up about 26,000 tons greater than supply, if we consider the buffer stock apart. Naturally, the pool and unexported stocks of producers overhang the market. Figures, though preliminary, indicate a sharp about face from 1957 when output exceeded consumption by 16,000 tons. World stocks, again excluding Russia, probably fell about 15,000 to 17,000 tons by year end.

A controlled market is generally a vague one. The outlook for tin in 1959 is uncertain. Certainly producing countries cannot continue export cutbacks of 48% without tightening the market. The degree of tightness and the time of its occurrence depend primarily on demand, particularly in the U.S. Indications are that U.S. consumption dropped about 10,000 tons in 1958, from 55,000 to 45,000 tons. No real improvement in the U.S. market is forecast before the second quarter. Supply here was considered adequate as the year ended. The contango in the U.S. had dissolved, but

. . . "Feldspar production in 1958 was near the 1957 figure. Imports of ground product from Canada increased during the year and spar produced by flotation also improved its proportion of the total figure." p 143

Taber de Polo
Commodity Specialist, U.S. Bureau of Mines

continued on the London Exchange.

The Russians were silent as 1959 began. With negotiations completed ITC had the unpleasant prospect of again attempting to balance the market through personal sacrifice. Import restrictions would have to go. The Russians had gained a large piece of the market. Knowledge of Russian exports, which allows for planning, seemed to be the only ITC gain. Many observers, with an eye on China, remained suspicious.

Under the assumption that Russia will cooperate, it is reasonable to look for the market to move up to the £780 level. At this point the pool manager may begin sales aimed at improving his cash position and bringing supply and demand into balance.

Most observers look for the pool to gradually rid itself of stocks purchased with the special fund. Over-all success of ITA depends on its ability to relax quotas in 1959. A balanced market at the cost of 48% cutbacks offers little consolation to producing nations. Many feel ITA will not be in a position to loosen quotas until the second half of 1959.

Barter may help. At its final 1958 meeting in December ITC exempted from export restriction stocks of producing countries shipped to the U.S. Government through barter. Bolivia, reported near bankruptcy, was negotiating with the U.S. as the year ended. Barter deals are invariably closed at beneath the current U.S. market price. Producing countries, bogged down by restrictions, would probably be pleased to rid themselves of surpluses at as much as 10¢/lb below the market. Bartering of pool holdings would result in great losses to members and is unlikely, but the option probably serves as some kind safety valve.

If lack of demand or Russian exports force continued high quotas, barter could conceivably be a major market support in 1959.

The strain on ITA has begun to show. Producing members have started to bicker, with several nations accused of violating export quotas. Investigations by governments of the accused countries are unlikely to produce offenders. ITC would probably benefit from an investigation of its own. If nothing were uncovered, the accused would be cleared. If violations were found and checked, ITA would be strengthened—if unchecked, the organization would be doomed.

Despite firmer prices there is yet no shortage. Many feel ITA has countered the buying lethargy periodically by quietly supporting the Singapore market. ITA will have to improve its cash position in 1959, and must try to ease quotas. There is little chance quotas will be eased until ITA stockpiles are cut down•

Aluminum

Irving Lipkowitz
Reynolds Metals Co.

DOMESTIC primary production amounted to 1,557,000 tons in 1958, about 6% below the 1957 total and 7% below the all-time record output of 1956 (1,678,954 tons). It was also the lowest production since 1954.

The decline which had begun in the second half of 1957 continued through the first half of 1958. By the middle of 1958, U.S. production was about 17% less than it had been a year earlier, despite a continuing increase in capacity. The net result was that 30% of the nation's primary aluminum capacity was idle at mid-year.

Improved business brought a slight upturn in production by the third quarter and by the fourth quarter production was running 4% ahead of the previous year. Since new capacity continued to come into operation, about 20% of the nation's capacity was still idle at the end of the year. (See table p 128.)

Two new domestic producers of primary aluminum, Ormet and Harvey Aluminum, began operations during 1958, bringing the number of producing companies to six. However, since Ormet is a captive producer, jointly owned by Olin Mathieson and Revere Copper & Brass, there are actually seven domestic sources of primary aluminum. The two new producers added 198,000 tons to the nation's capacity and another 172,250 tons of new capacity were also completed by the other producers, bringing the total domestic capacity in place at the end of 1958 to 2,209,250 tons. This amounted to a 20% increase in primary capacity during the year. (See table p 128.)

If market conditions had warranted, still more capacity would have been completed during 1958. However, with some producing facilities shut down during the year for lack of demand, construction on some new plants was either suspended or slowed down. These and other new facilities under actual construction at the end of 1958 amount to another 395,500 tons of domestic capacity.

Canadian production totaled 610,000 tons in 1958, compared with the abnormally low output of 557,000 tons in 1957 when a lengthy strike had shut down Canada's largest plant. During 1958, Canada's largest producer (Aluminium Ltd.) was also operating below capacity for lack of demand and had suspended construction on 90,000 tons of new capacity at its Kitimat plant. Canadian British Aluminium Co., which had begun production in 1957, brought its second unit of 45,000 tons into operation during 1958. Aggregate primary capacity of Canada's two producers was 860,000 tons at the end of 1958.

Western European production in 1958 began to level off, although the estimate for the year, 714,000 tons, would set another new record. Output in 1957 was slightly less, at 712,000 tons. Production controlled by Western European producers, however, includes 49,600 tons of African capacity which Pechiney is operating in the Cameroons, and 90,000 tons of Canadian capacity, 60% of which is owned by British Aluminium.

Soviet bloc production took another big leap upward in 1958, to 855,000

tons, if the available unofficial information is correct. Unfortunately, no official figure can be obtained because the state secrets law of the USSR prohibits publication of aluminum production data. The reported 1958 production is 19% higher than the year before and makes the Soviet group the world's second ranking aluminum producer by a comfortable margin. As the tabulation on p 129 shows, the Soviet group has also narrowed considerably the U.S. lead as the world's largest producer. In 1956, U.S. primary production exceeded Soviet output by more than 1-million tons. By 1958, the production advantage enjoyed by the U.S. had been cut down 30%, to 702,000 tons. Since the end of World War II, the Soviet share of world aluminum production has climbed from 12 to 22%, while the U.S. share has dropped from 48 to 40%.

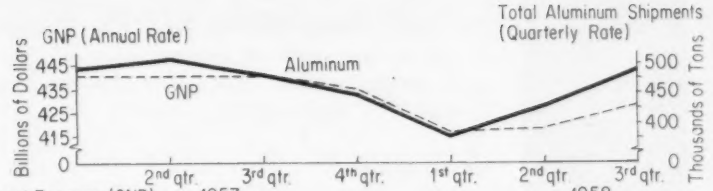
Total U.S. supply in 1958 was 7% below the 1957 level, 2,164,000 tons against 2,331,000. Principal cause of the drop was the 91,000 ton reduction in domestic primary output, and 79,000 tons less secondary metal recovered from scrap. These declines were slightly offset by a 3,000-ton increase in primary imports, resulting in a net decline of 167,000 tons for 1958 against 1957:

U. S. Aluminum Supply

(Thousands of tons)

	1957	1958
Primary		
Domestic	1,648	**1,557**
Import	226	**229**
Scrap (recoverable content)	457	**378**
Total	2,331	**2,164**

Once again, as was the case the year before, 1958 domestic supplies (primary and scrap) were more than sufficient to meet the market requirements. The slight increase in the relative position of primary imports from 9.7% of the 1957 supply to 10.6% of the 1958 supply, therefore was not due to any deficiency in domestic supplies. In fact, as explained earlier, substantial amounts of domestic primary capacity had to be shut down during the year because of insufficient market demand. Both the decrease in domestic supplies and the increase in imports were the result of similar market conditions: the excess of supply over demand. Such an excess in foreign markets stimulated increased exports to the U.S., just as the excess here brought about the reduction in domestic production.



	1957			1958		
	2nd qtr.	3rd qtr.	4th qtr.	1st qtr.	2nd qtr	3rd qtr.
National Economy (GNP) Billion 1957 Dollars	442.8	442.4	434.1	418.0	419.0	428.3
Aluminum Shipments Thousand Tons	503	485	446	378	433	489

	1957-58 Recession (2nd qtr. 1957 - 1st qtr. 1958)	1958 Recovery (Since 1st qtr.) 1st - 2nd qtr.	1st - 3rd qtr
National Economy (GNP)	-24.8 Billions	+1.0 (+4%)	+10.3 (+42%)
Aluminum Shipments	-125 Thousand Tons	+55 (+44%)	+111 (+89%)

Shipments to consuming industries during 1958 reflected the industry's recovery from recession levels. This recovery, characteristically, has been stronger than that experienced by the general economy. After the 1954 recession, aluminum shipments picked up more than business did generally and that happened again in 1958.

The recession for both the national economy (as measured by the Gross National Product, covering all goods and services) and the aluminum industry came between the second quarter of 1957 and the first quarter of 1958. As the accompanying chart shows, GNP dropped $24.8-billion (on an annual basis) during the recession while quarterly aluminum shipments fell 125,000 tons. During the second quarter of 1958 the national economy recovered $1.0-billion, or 4% of the decline in GNP, while aluminum shipments increased 55,000 tons, regaining 44% of its lost ground. By the third quarter, the national economy had recaptured 42%, and aluminum shipments 89%, of their respective recession losses.

Despite the relatively strong recovery of aluminum shipments during most of 1958, the total for the year was 7% below 1957, 1,800,000 tons against 1,926,000 tons. The 1958 shipments to consuming industries amount to about 83% of the year's supply, the same as in 1957. About 330,000 tons of the remaining 364,000 tons of 1958 supply were shipped by the primary producers to the Government pursuant to their "put" rights under the Korean War mobilization contracts. The put rights of Alcoa and Kaiser expired during 1958, and those of Reynolds amounting to 38,000 tons, run out in 1959. Harvey, a new producer, has the nominal right to put 54,000 tons a year over a five-year period.

A product breakdown of 1958 shipments to consuming industries reveals considerable variations in their individual patterns of recovery from the recession. Shipments have increased for all product groups since the first quarter of 1958, but some have made much more progress than others toward pre-recession levels. Extrusions and tube shipments in 1958 (nine months) were within 2% of the 1957 level for the same period. This strong showing is particularly significant since this has been the fastest growing product group in the industry since World War II. Wire, rod and bar shipments, however, were 35% lower during 1958 (nine months) than during the comparable period in

"Copper company profits will be better in 1959. Prices will be considerably higher and sales volume will be up. Threatened strikes could limit volume, but the greater price rises might more than compensate." *See p 135*

George H. Cleaver
Market Editor, *E&MJ*

". . . The growing financial strength of Western Europe became visible at year-end when all principal currencies were made convertible for non residents. U.S. businessmen may gain." *See p 113*

Dr. M. A. Kriz
Associate Economist, First National City Bank of New York

1957. (See table, center column.)

World market conditions probably had a greater impact on the domestic aluminum industry in 1958 than ever before. One major reason was the sharp expansion of production and fabricating facilities in Western Europe as well as in the U.S. (See table.) With excess fabricating and primary capacity or supply available, foreign countries made a stronger drive for U.S. markets and the domestic industry made a more intensive effort to find or develop larger export markets. Part of this effort took the form of investment by domestic companies in foreign aluminum companies.

The net result was an increase in both imports and exports. Primary imports increased very slightly from 226,000 tons to 229,000 tons, or less than 2%. Tonnage statistics, however, do not tell the full story. The significant fact in 1958 was that although domestic facilities were more than ample to supply all needs, imports displaced some primary production. By contrast, in 1953, primary imports were substantially larger — 301,000 tons — and at that time the total market was much smaller than it was in 1958. However, 1953 was a shortage year and, therefore, that year's imports supplemented rather than displaced domestic production.

Mill product imports presented a similar problem during 1958, although they also showed a considerable increase over 1957. The principal import category (sheet, plate, bar and rod) increased 37% in 1958 over the same period (first nine months) in 1957. Foil imports increased 40% over 1957 levels during the same period. Domestic facilities, however, were more than sufficient to supply total requirements. The increased flow of imports added to excess supply and weakened the price structure in domestic markets, particularly in the eastern part of the country.

Mill product imports do not as yet loom large, statistically, when the traditional comparison with total domestic shipments are made. However, such comparisons do not portray accurately the effect of these imports on U.S. markets. Import statistics are grouped on a tariff rate basis without regard to their separate markets. These statistical comparisons are necessarily on a nationwide basis even though imports are concentrated much more in some areas than in others. Finally, the impact of imports can be out of proportion to the tonnage involved if they come into regional markets where an excess of supply already exists.

Exports still accounted for a minor segment of the domestic industry's business in 1958 even though increased effort was made to expand such sales. Primary and scrap exports in 1958 (first 10 months) amounted to 57,000 tons, compared to 38,000 tons the year before. Mill product exports for the first 10 months fell from 17,600 tons in 1957 to 12,200 tons in 1958.

Continued Soviet aluminum shipments to European markets stirred up considerable concern and discussion during 1958. Early in the year antidumping action was sought against Soviet primary shipments to the British market. No action was taken by British authorities on the request. However, Soviet shipments declined steadily during the first half of 1958 and virtually ceased during the second half of the year. Soviet authorities also announced in October that they would limit future shipments to Britain to a maximum of 16,500 tons a year which, while only slightly below the rate of the shipments during the first half of 1958, was about half the rate of its shipments during the second half of 1957.

What caused so much concern was not the tonnage volume of Soviet exports as the disruptive marketing methods used and the lack of basic information as to how much Soviet aluminum is likely to be available for export in the future. The absence of adequate information on Soviet production and consumption leaves the question of future Soviet exports to Free World markets very much of an open question.

Another East-West aluminum trade development was the relatively large export of primary aluminum, 15,000 tons, from France to Communist China during the second half of 1958.

Prices. Two unusual price developments took place in the U.S. market in 1958: a 2c per lb cut in base price April 1 and a price "freeze" on all primary and mill products beginning early in December and extending through June 30, 1959. Both of these unprecedented actions were initiated by Aluminium Ltd. There was also an 0.7c price increase in August, when an automatic wage increase became effective under the three-year labor contracts of the domestic producers. The contracts expire during the summer of 1959. The net result was that during 1958 the base price of aluminum dropped from the 26c level, which had prevailed since August 1957, to 24c on April 1, went up to 24.7c in August and was frozen at that level in December.

The April price cut was world wide, with only minor variations as to the exact amount. Costs could not explain the move because they were still rising —as they had been during prior years.

Shipments by Product*

(Thousands of tons)

	1958	1957	Decrease
Sheet and plate	**424**	470	−10%
Ingot for castings & destructive uses	**353**	439	−20
Extrusions & tubing	**295**	301	− 2
Foil	**72**	75	− 4
ACSR	**68**	70	− 3
Wire, rod, bar	**61**	94	−35
Covered wire	**18**	19	− 6
Powder & paste	**10**	12	−14
Total	**1,301**	1,480	−12%

* 9 months.

Primary Aluminum Capacity

(Tons)

Company	Dec. 31, 1958	Dec. 31, 1957
Alcoa	**813,250**	792,500
Reynolds	**601,000**	488,500
Kaiser	**537,000**	498,000
Ormet	**144,000**	—
Anaconda	**60,000**	60,000
Harvey	**54,000**	—
Total	**2,209,250**	1,839,000

Some observers saw in this step Aluminium Limited's reaction to world supply-demand conditions. Aluminium Limited's heavy dependence on primary sales in world markets exposed it more than other producers to the impact of an expanding world production and of the appearance of Soviet aluminum in some of its traditional markets at a time when demand was sluggish.

Aluminium Limited's announcement gave market development as the reason for its April price cut.

The December price freeze began with an announcement by Aluminium that it was discontinuing the 60-day price protection which it had initiated in November 1957. In conjunction with this action, it also offered to maintain the December price on primary aluminum deliveries through June 30, 1959, provided the orders were placed prior to Jan. 1, 1959. Domestic producers promptly met this action by extending the price maintenance to mill products as well and by subsequently eliminating the necessity of placing the orders before Jan. 1, 1959.

Market development. With producing and fabricating capacity substantially greater than current demand, the domestic industry concentrated its efforts during 1958 on developing new and better uses and markets for aluminum. Significant gains were made in all major markets. But more significant than the tonnage gains already realized are the broad foundations being established for much larger tonnage gains during the years ahead. A good example is what has been happening in the construction market, already aluminum's largest.

Construction use was notably expanded by the large scale adoption of aluminum by some major builders of residential housing. Under one of these programs, over 100 houses averaging 2,500 lb of aluminum each, were sold during 1958. Under another program, the nation's largest manufacturer of prefabricated houses, introduced a line of its houses which use 1,400 to 3,000 lb of aluminum each. In both cases, the public has been showing a marked preference for the aluminum model houses. The tremendous spurt forward which these programs represent is indicated by the fact that until now the typical house contained well under 100 lb of aluminum.

Progress made in 1958 by both of these housing programs is only a beginning. The prefabricated house manufacturer is rapidly proceeding with plans to market his line of aluminum houses through 600 builder-dealers. The other program is being extended from the few test-markets covered in 1958 to about 150 areas.

Three new aluminum bridges were introduced by the industry during 1958, offering many construction and maintenance advantages. With an estimated 60,000 to 70,000 bridges to be built under the Federal highway program, the aluminum industry expects to gain a substantial tonnage market.

The automotive market experienced further growth on a per car basis, with consumption of aluminum in 1958 climbing to 52 lb, compared with 12 lb in 1948. Here again, much sharper advances in the use of aluminum are indicated for the years ahead. Successful testing of all-aluminum engines was announced during the year by the largest car manufacturer. The adoption of this single new use would multiply the per car consumption of aluminum many times. These and other applications which are in advanced stages of development promise to increase aluminum usage per car year by year, to 59 lb in 1959 and eventually to 200 lb by 1970.

Both foil packaging, a relatively old aluminum market, and cans, a relatively new one, show strong potentials for further expansion. Foil packaging sales were highly resistant to recession pressures, maintaining as high a level of sales (about 90,000 to 92,500 tons) in 1958 as in 1957. Although the use of aluminum foil in packaging has doubled in the past five years, 1959 is expected to show an 11% increase over 1958. With tens of millions of aluminum cans (oil, beer, food) already being used, a beginning has been made in the can market. Aerosol cans promise to become another consumer of aluminum soon.

Behind these advances and similar progress in other markets are the industry's research and advertising programs. Expenditures for these purposes continue to mount. In 1959, an estimated $30-million will be spent for research and another $35-million for advertising.

The industry's commitment to growth expenditures — whether for larger and better facilities, research or marketing—reflects its outlook. While the statistical estimates range from over 10% to over 20%, all observers (Government and industry) agree that the industry's prospects are for bigger sales and more aluminum consumption in 1959 than in 1958. In all cases these estimates are based on what the industry is actually doing to build larger markets rather than on abstract optimism or theoretical statistics•

World Aluminum Production

Area	Thousands of short tons					Percent of world production		
	1936	1946	1956	1957	**1958**	1939	1946	**1958**
United States	164	410	1,679	1,648	**1,557**	22%	48%	**40%**
Soviet Sphere	55	104	641	719	**855**	7%	12%	**22%**
W. Europe	416	140	673	712	**714**	55%	16%	**18%**
Canada	82	193	615	557	**610**	11%	23%	**16%**
Other countries	39		107	123	**170**	5%	1%	**4%**
World total	756	855	3,715	3,759	**3,906**	100%	100%	**100%**

U. S. Primary Output by Quarters

(Short tons)

	1st Q.	2nd Q.	3rd Q.	4th Q.	Total
1958	**395,909**	**366,652**	**368,670**	**425,769**	**1,557,000**
1957	401,795	422,333	414,766	408,816	1,647,710

Silver

Francis H. Wemple
Handy & Harman

ANOTHER YEAR has been added to the unusual history of price stability for silver. For eight years the published price in New York has fluctuated within a range of less than 10c a troy oz, and for the last three years the entire spread between the low and the high has been just 3c. The degree of

stability has varied in different countries, but prices throughout the world have been subject to the same basic conditions. The policies of the Bank of Mexico and of the U.S. Treasury Department have been the dominant influences of the current decade.

During 1958 prices in New York on the average were somewhat below those of 1957, and fluctuations again took place within very narrow limits. The low for the year of 88⅝c per troy oz was established Jan. 27, and the high of 90⅜c was reached Oct. 14. This was a total spread of just 1¾c, identical with that of the previous year.

The year opened on a firm note. On Jan. 2, the first business day, the published price went up ⅛c to 89¾c per troy oz. The next day another ⅛c increase was posted. This rise, however, was only a temporary interruption to the downward price trend which started in the closing weeks of the previous year. The price dropped ¼c Jan. 15, and by the 27th of the month had declined to 88⅝c, which proved to be the low for the year.

For the next eight months no further change took place in the published rate for silver in New York. Supplies and demand remained in close balance. There were occasions, particularly during the vacation season, when producers were not able to find a ready market for all their output, and from time to time metal produced in Mexico was offered to the Bank of Mexico at the current market price, and the offers were accepted. In this way a measure of stability was provided to the market. We estimate that the total of such sales to the Bank during 1958 probably did not exceed 6-million oz.

By September, improved business conditions both in this country and abroad resulted in an increasing demand which was soon reflected in the market. On Sept. 26 the price went up to 88⅞c, and fractional improvements continued through the next few weeks. Around mid-October it became necessary to bring some domestic silver into the market, and on the 14th of that month the published rate reached 90⅜c. For the first time in almost a year a portion of domestic production was diverted to the market, rather than being delivered to the Treasury Department. But the need for domestic silver was of short duration. In less than three weeks, on Nov. 3, the price dropped to 90⅛c, and U. S. production again reverted to the Treasury.

Early in December, signs of weakness appeared in the London market which resulted in declining prices. By Dec. 11 quotations there were such as to make it advantageous to ship silver to New York. Sellers here reacted promptly, however, and on Dec. 11 and 12 successive declines in New York carried the published rate to 89⅝c. Offers from abroad soon disappeared and in the face of continued good demand, the price recovered to 89⅞c Dec. 17, where it remained unchanged for the balance of the year.

U. S. Trade in Silver

(Millions of ounces)

	1958	1957	1956	1955
Imported from:				
Canada	**19.2**	18.0	20.0	21.2
Mexico	**20.4**	16.5	18.9	21.5
Peru	**16.1**	13.1	11.4	10.9
Bolivia	**3.1**	3.5	5.5	3.0
Cuba	**.4**	.3	.2	.4
Other Western hemisphere countries	**5.9**	4.8	4.3	4.0
Total Western hemisphere	**65.1**	56.2	60.3	61.0
United Kingdom	**.1**	22.3	67.7	.1
Netherlands	—	4.7	19.3	16.8
Other European countries	**.1**	.1	—	—
India	**83.0**	89.5	—	—
Pakistan	**4.8**	30.3	—	—
Australia	**1.5**	1.7	11.5	1.6
All other countries	**6.3**	1.3	4.0	5.0
Total imports	**160.9**	206.1	162.8	84.5
Exported to:				
Mexico	**1.7**	1.3	1.7	1.5
U. K.	**.1**	3.9	1.6	.6
W. Germany	**1.0**	2.8	.3	1.9
All others	**.1**	2.3	1.9	.8
Total exports	**2.9**	10.3	5.5	4.8

Lend Lease

(Millions of ounces)

Country	Original obligation	**Total returned through 12/31/58**	Balance outstanding 12/31/58
India	172.5	**172.5**	—
United Kingdom	88.1	**88.1**	—
Netherlands	56.7	**56.7**	—
Pakistan	53.5	**35.1**	18.4
Saudi Arabia	22.3	—	21.3
Australia	11.8	**11.8**	—
Ethiopia	5.4	**4.6**	.8
Belgium	.3	**.3**	—
Fiji Islands	.2	**.2**	—
Total	410.8	**369.3**	40.5

Consumption of silver in U. S. arts and industries during 1958 amounted to about 85-million oz. This compares with 95-million for the previous year and an average for the past five years of 93-million oz.

The decline in consumption was general in all major categories. Well over half of all silver used in this country continues to go into industrial applications, as contrasted with the more traditional arts uses. One important area is the consumer durable goods industry, and there are definite indications of improvement in this category. Furthermore, a growing number of applications for silver and its alloys in electrical and electronic developments, not only in civilian but in defense programs, have tended to stabilize seasonal uses of the metal and are significant in its long range growth. The use of silver in sterling and plated ware is importantly affected by the number of weddings taking place, and this use should benefit from the predicted increase in the marriage rate over the next few years.

As has been true for the last few years, returns against lend-lease obligations again accounted for most of the U. S. silver imports during 1958. Total imports for the year amounted to 160.9-million oz. Of this figure 92.4-million represented returns against lend-lease, which was divided as follows: from India 83-million oz were received; from Pakistan 4.8-million oz; and from Ethiopia 4.6-million oz. Imports other than returns against lend-lease amounted to 68.5-million oz, of which 65.1-million oz were imported from Western Hemisphere countries, and 3.4-million oz from countries outside the Western Hemisphere.

Total U. S. exports during 1958 amounted to 2.9-million oz, representing a considerable decline from 1957. The principal countries of destination were Mexico, which received 1.7-million oz, and Western Germany which received 1-million oz. All other countries combined accounted for 200,000 oz. The export to Mexico from the U. S. resulted from technical problems relating to refining operations rather than any market considerations.

By the end of 1958 the return of lend-lease silver was largely accomplished. Under the terms of the original agreement, April 1957 became the repayment date, with provision for extensions in some instances. The accompanying table shows by countries the amounts already re-

turned and the balances still due at Dec. 31, 1958. It will be noted that the amount due from Saudi Arabia is 1-million oz less than the amount appearing as the original obligation, although nothing is listed as having been returned. The reason is that at the time of delivery of the original loan, this shipment was lost in transit and not replaced. Accordingly, the amount to be returned in kind under the terms of the original lend-lease agreement has been adjusted.

The return of lend-lease silver has brought about a sharp rise in Treasury free stocks. These stocks have increased by 188.6-million oz since the end of 1954. Of the original lend-lease obligation of 410.8-million oz, 305.4-million oz had been credited on the books of the Treasury by Dec. 31, 1958. This is less than the amounts actually returned because of delays in final determination. Assuming the ultimate settlement of all balances still outstanding, there remain more than 100-million oz to be credited to free stocks. It is from such stocks that silver is withdrawn for domestic coinage requirements and for sales under the Act of July 31, 1946.

Consumption of silver throughout the non-Communist world amounted to an estimated 250.5-million oz in 1958, a decrease of about 13% from 1957. About 187.4-million oz of this total were used in the arts and industries, and about 63.1-million oz for coinage. The figures represent declines of about 11% and 20%, respectively, from the previous year. The decline in the amount of silver used in the arts and industries is almost entirely accounted for by the 10-million oz reduction in the U.S. and the decline of 11.7-million oz in the case of India. As for coinage, virtually all of the decline in this category was accounted for by a reduction of 15.2-million oz in the amount used in the U.S.

Total production of silver in the non-Communist world amounted to about 204.7-million oz. This indicates an increase of about 3% over the previous year. A small decline in U.S. ouput was offset by increases in the production of Canada and Peru. All other countries in the non-Communist area accounted for an estimated 50-million oz, about 5% more than in 1957.

Outlook. The year 1958 has ended on an optimistic note for business in general. Silver is used in a wide variety of industries, and therefore its market is directly affected by business conditions.

Therefore, it is reasonable to ex-

Treasury Silver

(Millions of ounces)

	Dec. 31 1958	Dec. 31 1957	Dec. 31 1956	Dec. 31 1955	Dec. 31 1954
Held in Treasury:					
Securing Silver Certificates:					
Silver bullion	**1,736.3**	1,711.5	1,708.4	1,697.2	1,679.2
Silver dollars	**156.8**	169.4	182.8	196.1	207.0
Subsidiary coin	**10.9**	5.9	2.0	11.3	34.5
Free silver bullion	**202.2**	127.4	87.4	24.9	13.6
Total Treasury Stocks	**2,106.2**	2,014.2	1,980.6	1,929.5	1,934.3
Outside the Treasury:					
Silver dollars	**220.8**	208.3	195.1	182.0	172.5
Subsidiary coin	**1,046.0**	1,014.6	968.0	928.3	898.9
Total silver outside the Treasury	**1,266.8**	1,222.9	1,163.1	1,110.3	1,071.4
Total silver	**3,373.0**	3,237.1	3,143.7	3,039.8	3,005.7

World Silver Statistics

(Millions of ounces)

	1958	1957	1956	1955	1954
Production:					
Mexico	**47.0**	47.2	43.1	48.0	39.9
United States	**34.0**	38.7	38.7	36.5	35.6
Canada	**31.0**	28.4	28.4	28.0	31.1
Peru	**30.8**	25.3	23.0	22.9	20.4
Bolivia	**5.4**	5.4	7.5	5.9	5.0
Other South and Central American countries	**6.5**	6.6	7.0	6.4	7.8
Total Western hemisphere	**154.7**	151.6	147.7	147.7	139.8
Outside the Western hemisphere (partial)	**50.0**	47.4	51.6	50.7	49.4
World production (partial)	**204.7**	199.0	199.3	198.4	189.2
Consumption:					
Arts and Industries:					
United States	**85.0**	95.0	100.0	100.0	85.0
Canada	**3.9**	5.2	3.8	4.6	3.9
Mexico	**4.4**	3.9	2.9	2.5	1.3
Great Britain	**13.5**	13.5	13.9	14.2	12.6
France	**13.0**	12.3	15.9	15.7	15.0
Western Germany	**31.1**	31.5	33.1	28.1	24.2
India	**3.3**	15.0	17.5	3.0	3.0
Japan	**8.2**	8.8	8.1	6.3	5.8
Other countries (partial)	**25.0**	25.0	15.0	18.4	10.0
Total (partial)	**187.4**	210.2	210.2	192.8	160.8
Coinage:					
United States	**36.2**	51.4	31.2	8.2	53.1
Canada	**4.7**	4.7	3.2	2.6	.9
Mexico	**2.2**	3.1	4.9	2.3	—
Saudi Arabia	—	—	—	17.2	—
Other countries (partial)	**20.0**	20.0	17.2	22.3	29.4
Total coinage (partial)	**63.1**	79.2	56.5	52.6	83.4
Total consumption (partial)	**250.5**	289.4	266.7	245.4	244.2

Silver Quotations

	New York Price (cents)			London Spot (pence)		
	High	Low	Average	High	Low	Average
1958	90.375	88.625	89.044	78.750	74.750	76.211
1957	91.375	89.625	90.820	80.500	77.125	78.927
1956	91.625	90.000	90.826	81.375	76.625	79.132
1955	92.000	85.250	89.099	80.250	73.750	77.507
1954	85.250	85.250	85.250	74.375	72.000	73.482
1953	85.250	83.250	85.188	74.000	72.875	73.945
1952	88.000	82.750	84.941	77.000	72.500	74.360
1951	90.160	80.000	89.368	78.500	70.000	77.856
1950	80.000	71.750	74.169	70.000	63.000	64.796
1949	73.250	70.000	71.930	64.000	42.500	49.243

pect that U.S. consumption of silver in 1959 will exceed the 1958 figure. Furthermore, the needs of the market probably will require a larger portion of domestic silver than in the year just ended, in which case 1959 will see the price more frequently above the Treasury buying price for domestic silver than in the recent past. However, assuming that there will be no change in the policies of the U.S. Government, then in all probability the story of the silver market in the coming months will be little more than a continuation of that of the past several years•

Iron Ore and Steel

A. W. Knoerr
Editor

STEEL INDUSTRY OUTLOOK provides the best basis for the 1959 iron ore industry outlook. According to American Iron and Steel Institute, steel's four best customers are:

Market	Per cent domestic shipments 1957	1956
Automotive industry	18.9	17.8
Construction and contractors' products	16.5	15.0
Machinery and industrial equipment[1]	8.8	9.4
Oil and gas, including drilling	8.6	7.0
	52.8	49.2

[1]Includes electrical machinery.

It remains only to scan the outlook for these four major markets, which consume about half of the total output of steel, to sharpen up the 1959 picture for steel and the iron ore industry.

Automotive industry. Total U.S. factory production of autos and trucks was 5.3-million in 1958. Estimate for 1959 is about 6.2-million. Source: Ward's Automotive Reports and McGraw-Hill Department of Economics.

Construction and contractors products. Value of construction for 1959 is expected to total $70-billion. This includes an estimate of $51-billion for all new construction, both heavy and light; and $19-billion for maintenance and repair work. New construction is expected to exceed 1958 by slightly less than 5%. Private construction should rise about 2%; public construction is expected to be up by more than 11%. Source: *Engineering News Record, Construction Methods & Equipment, Construction Daily.*

Machinery and industrial equipment. Construction and mining machinery manufacturers look for 1959 sales to top 1958 sales by 9%. New orders for low-cost, high-capacity, earth-moving units will increase substantially. Producers of other industrial machinery estimate that 1959 demand will be 11 to 23% higher than in 1958. Builders of metal cutting and metal forming machine tools expect to ship about $575-million worth of tools in 1959, or 22% more than they shipped last year. Manufacturers of heavy electrical apparatus—transmission, distribution and generating equipment—anticipate a 3% gain in physical volume of shipments this year. Source: McGraw-Hill Department of Economics, Federal Reserve Board, and *"Pulsebeat of Industry,"* a McGraw-Hill report.

Oil and gas. Capital spending plans for the petroleum industry—closely related to steel consumption in that field—are estimated as follows: 1958, $5.158-million; 1959, $5.442-million; 1960, $5.439-million. Totals include expenditures planned for production, transportation, refining, marketing and others. Source: U.S. Department of Commerce, Securities and Exchange Commission, McGraw-Hill Department of Economics.

Other industries. The container industry, which consumes about 8.4% of total steel shipments is dependent upon the food and beverage industry for 80% of its metal can output. According to *Food Engineering,* food and beverage production for 1959 should exceed 1958 production by about 5%. The railroad industry uses about 5.4% of the total annual shipments of finished steel. Railroad equipment manufacturers expect unit volume shipments for 1959 to be 10% higher than in 1958. Capital expenditures of the railroad industry are expected to be 3% higher in 1959 than in 1958, and 21% higher in 1960.

Impact on steel. Steel producers agree that 1959 will be a much more active year than 1958. Joseph L. Block, president of Inland Steel Co., estimates that steel ingot production during the first half of 1959 will aggregate between 55- and 58-million tons. Production during the first half of 1958 was 47-million tons. Mr. Block expects 1959 steel ingot production to total 110- to 116-million tons. E. J. Hanley, president of Allegheny Ludlum Steel Corp., looks for strengthening steel demand during the first and second quarters of 1959, with a possible setback in the third quarter because of a strike, or overbuying during the second quarter in anticipation of labor interruptions.

Steel producers surveyed by the McGraw-Hill Department of Economics estimated that the output of steel ingots and castings would increase from the 1958 total of 85-million tons to 107-million tons for 1959. If the 107-million-ton total will be produced, 1959 will be the fourth highest year in the history of the steel industry.

Impact on iron ore production. As indicated in the introduction, the low steel output for 1958 had an immediate effect on the iron ore industry. Shipment of iron ore down the Great Lakes was 53-million tons—the lowest in 20 years. But conversely, with a favorable outlook for steel in 1959, predictions now are that Great Lakes iron ore shipments for 1959 will be about 70-million tons—an increase of 30%.

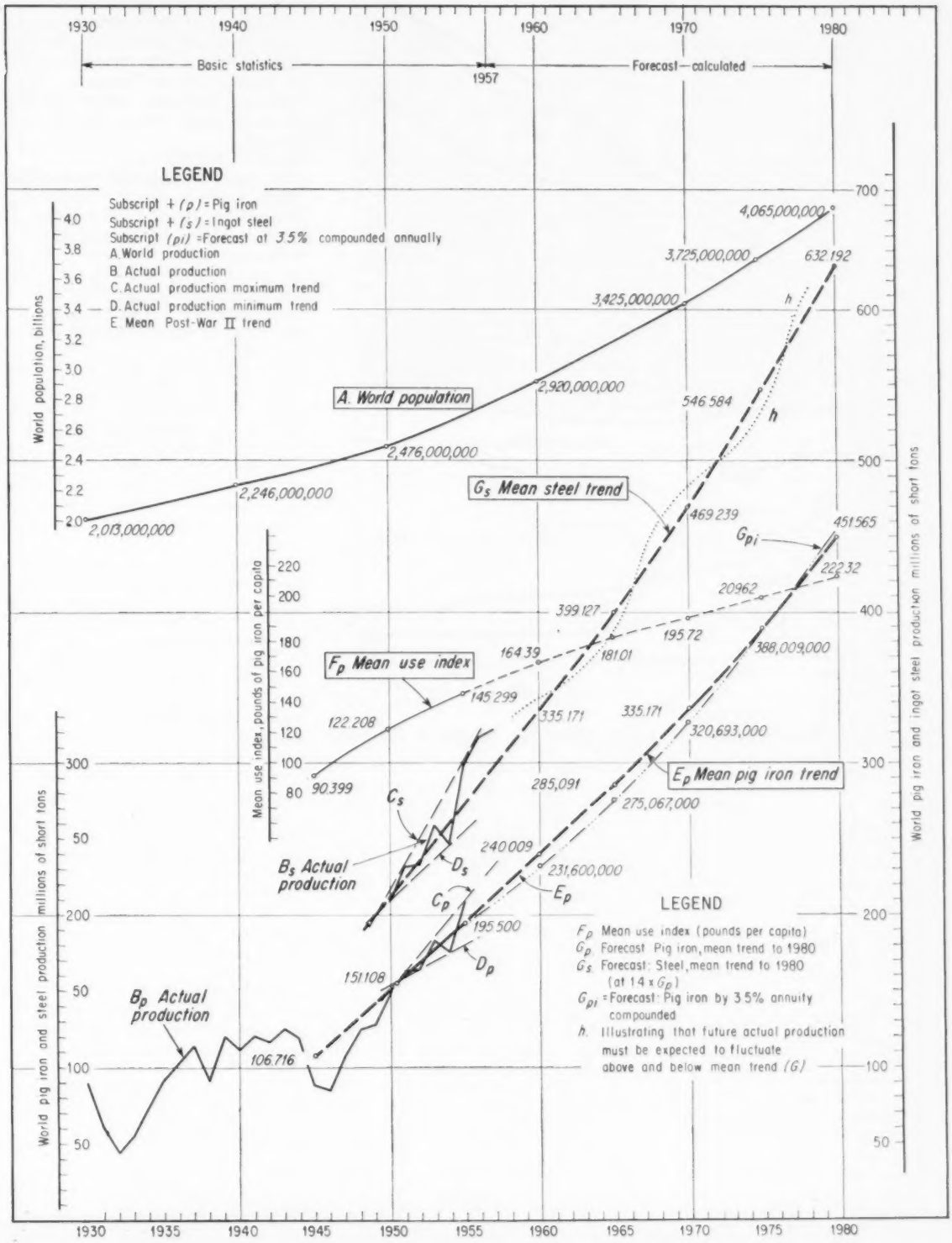
Long-range outlook. Two charts are included to show the necessity for long-range planning in the iron ore and steel industry:

Actual and potential sources of iron ore for steel plants of the U.S., projected through 1988. This is a revision and extension of previous forecasts made by Verne D. Johnston, consultant and specialist on iron ore sources.[2] The chart includes a composite of forecasts of requirements by various steel plant executives, and estimates by James C. O. Harris. Even with extensive expansion in the taconite industry and in production outside of the Great Lakes area, it is evident that the U.S. will find it hard to exceed the 100-million-gross-ton level of output, also that imports will have to increase substantially. See p 134.

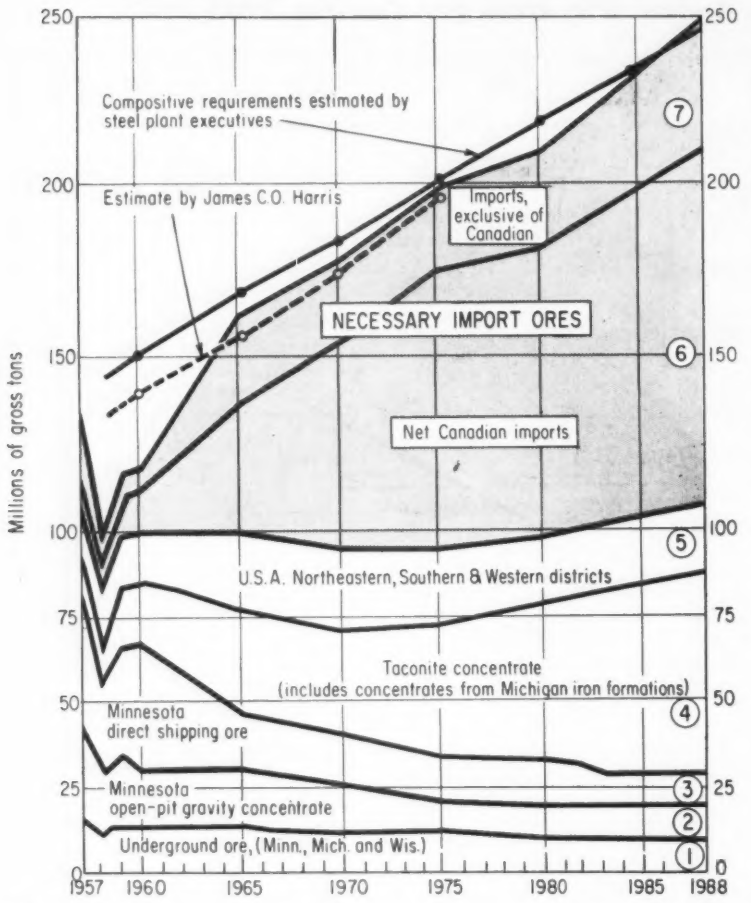
World requirements for pig iron including ferroalloys and ingot steel through 1980.[3] This chart, prepared

[2] "An Expert Looks at Iron Ore Sources in 1984," Verne D. Johnston, *E&MJ*, December 1955.
[3] "Forecast of Nickel Production to 1980 Based on Projection of Mean Trend," F. C. Fearing, *E&MJ*, April 1958.

World Pig Iron and Ferroalloys and Ingot Steel Production, and Forecast to 1980. World Population, 1930-1980, as Determined by United Nations, and Resulting Use Index (Pig Iron per Capita) 1945-1980.



Actual and Potential Sources of Iron Ore for Steel Plants of the U.S. Projected Through 1988



Classified Tonnages of Iron Ore as Shown Above

(Million of gross tons)

	1	2	3	4	5	6	7
1957	15.2	25.4	41.9	5.7	19.5	8.9	21.1
1960	14.0	21.0	32.0	14.0	20.0	10.0	10.0
1965	14.0	17.0	15.0	29.0	22.0	40.0	25.0
1970	12.0	14.0	11.0	35.0	22.0	60.0	25.0
1975	12.0	10.0	11.0	40.0	22.0	80.0	25.0
1980	10.0	10.0	8.0	50.0	20.0	80.0	30.0
1988	10.0	10.0	8.0	60.0	20.0	100.0	40.0

The above table and chart of estimated iron ore requirements were prepared by Verne D. Johnston for a lecture presented at the University of Minnesota in May 1958. Table has been revised to include year-end statistics. Figures for 1958 not available

by F. C. Fearing, is similar to a long-range world forecast on nickel consumption published in April 1958. For those readers not concerned with detailed statistical and mathematical analysis, the following curves underlined on the chart on p 133 will be of greatest interest:

A. World population.

G_s Mean steel trend.

F_p Mean per capital use of pig iron.

E_p Mean pig iron trend.

Calculations are based upon the United Nations estimates of world population growth, world pig iron and ferroalloy production, world ingot steel production, and a precise mathematical projection of post-World War II mean consumption trends. Mr. Fearing points out that steel production may be very closely estimated by multiplying pig iron tonnages by the factor 1.4, which was used to obtain curve G_s, or the mean steel trend. It is also expected that the actual production figures will vary above and below the mean trends, as indicated by the wavy dotted line.

Space does not permit the detailed explanation of the derivation of this chart. However *E&MJ* will send complete copies of Mr. Fearing's report to readers who are interested in the statistics, formulas, calculation and premises upon which the chart is based.[4]

A year of technical momentum. With respect to output, 1958 was a disappointing year to the iron ore and steel industries, but from a technical viewpoint, 1958 may have been one of the great significant years in the history of iron ore and steel production. For it was during 1958 that the technique of direct reduction of iron ores got off to a rolling start. Virtually every steel company is now taking a close look at the possibilities which direct reduction offers. Speakers on this subject attracted large audiences at mining, metallurgical and steel meetings throughout the country. In one paper, no less than thirteen type processes were described, including the blast furnace and variations of it.[5]

Authorities clearly indicated that direct reduction is gaining a momentum that will affect the future of the iron ore and steel industries around the world for decades to come. Here are some of the advantages cited:

1. Many countries which heretofore could not afford a steel industry because of the high cost of blast furnaces, the lack of coking coal, or the lack of high-grade ores, can now look hopefully to small domestic steel industries.

2. The dependence of the steel industry on unpredictable scrap prices and availability will be minimized.

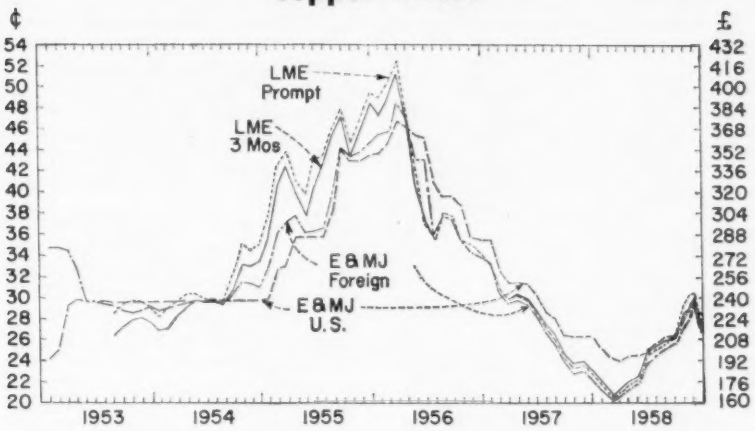
3. The buildup of copper and other contaminating elements in steel due to the run-around of scrap in the steel-making process can be offset by the greater use of purer direct-reduced iron.

4. Many future ores will be low-grade and require fine grinding. Direct reduction lends itself to the treatment of such ores•

[4]Send request for free copy of "Pig Iron and Steel Forecast by F. C. Fearing," to Engineering & Mining Journal, 330 West 42 St., New York 36, N. Y.

[5] "The R-N Direct Iron Process," D. E. Babcock, metallurgical engineer, Republic Steel Corp. A paper presented at the Cleveland and Birmingham technical meetings of the American Iron & Steel Institute. He discusses, in addition to the regular blast furnace and the special Domnarfvet kiln, the Wiberg, Tysland-Hole, Hoganas, Krupp-Renn, National-Titan, Republic Steel, Esso-Little, the U.S. Steel, and the R-N Corp. processes, all of which are in various stages of development today.

Copper Prices



Monthly averages. *E&MJ* prices are weighted average prices per lb computed from actual reports made to *E&MJ* by copper selling firms. These may be from 140,000 to 185,000 tons a month. They are reduced to f.o.b. U.S. refinery Atlantic seaboard. The London Metal Exchange prices are the average of the bid and asked and refer to long tons. The two scales, cents per pound and £ sterling per long ton, are equal at an exchange rate of $2.80 per £. At this rate £320 per long ton is equal to 40¢ a pound of metal, etc. Data through December 1958.

Copper Statistics (a)

(Thousands of short tons)

U. S.	1958	1957	1956
Output			
Mine	1,008	1,116	1,133
Secondary (b)	426	444	468
Refined	1,447	1,617	1,580
Imports (c)			
Ore, etc	85	125	122
Blister	240	301	276
Refined	120	162	192
Net imports (ore, blister, refined (c)	70	190	317
Net imports, scrap (g)	—26	—87	—51
Net imports, (mfg. & semi-) (c)	37	12	16
Exports, refined (c)	355	346	223
Stocks, ref., producer	81	181	121
Del. to fabricators	1,195	1,278	1,466
Del. by fabricators (d)	1,165	1,282	1,416
Fabricator stocks (end of year) (d)	447	430	437
Apparent consumption (e)	1,112	1,239	1,367
Actual consumption (f)	1,252	1,350	1,514
World			
Mine output	2,708	2,808	2,863
Refined output	2,806	3,036	2,987
Refined, del. to fabricators	2,917	2,853	2,833
Stocks, ref., producer	259	458	354
Prices, per lb, in cents,			
E&MJ, U. S., f.o.b.	25.764	29.576	41.818
E&MJ, foreign, f.o.b.	24.123	27.157	40.434

(a) Unless otherwise indicated, based on Copper Institute data. An estimated 400,000 tons of Free World copper (all outside the U.S.) is not reported to C.I. An estimated 500,000 tons produced outside the Free World is also excluded.

(b) From old scrap, alloyed, unalloyed, and other, based on Bureau of Mines data.

(c) American Bureau of Metal Statistics. Based on U.S. Census Bureau data.

(d) Based on Copper Association data. Stocks include refined metal, metal in process, metal in products and in inventory.

(e) From U.S. Bureau of Mines. New refined copper withdrawn from years total supply on domestic account. Estimate by E&MJ

(f) From Bureau of Mines; actual reports from foundries and fabricators. Estimate by E&MJ

(g) American Bureau of Metal Statistics based on U.S. Census Bureau data. Shown as negative —the figure measures the extent to which exports exceed imports.

Copper

George H. Cleaver
Market Editor

THE COPPER INDUSTRIES can look forward to better conditions in 1959. Both higher prices and a greater volume of business are likely. Prices in the U.S. for producers in January 1959 were about 15% higher than in January 1958. Custom smelter and merchant prices were higher by an even larger percentage. In Europe prices were about 25% higher than in January 1958.

A year ago, prospects were for no immediate improvement and it appeared probable they would become worse. In 1959 they will not get worse and will probably continue to improve.

A sharp business recession which began in the U.S. in 1957 had depressing effects for the Free World copper industries in 1958. Copper is consumed largely in products the purchase of which is postponable. Changes in economic conditions are usually sharper both for the downward adjustments and the upward adjustments than for those industries producing non-durable goods. The U.S. economy began 1959 in the midst of an upward economic swing and unless economic conditions in Europe, which have been hesitant in the last half of 1958, worsen considerably, the year will be much better than 1958, and the copper industries may be as profitable as in 1957. Though more rational spending by consumers of final products is predicted by many analysts, the increasing belief that inflation will become more serious may more than offset this. It will doubtless influence spending by industry and a decreasing emphasis on maintaining a large cash surplus may become evident. This could be encouraging to economic conditions not only by the direct spending effect but also by reducing the rise in interest rates—higher interest rates ordinarily discourage modernization. A large payout of earnings may also develop, which can lead to greater consumer spending.

U.S. Copper and Brass Mill Shipments

(Millions of lb)

	Copper				
	Sheet	Wire	Rod	Pipe Tube	Total
1955	273	6	72	468	819
1956	223	9	88	418	737
1957	190	6	67	381	644
1958	**146**	**5**	**51**	**416**	**618**
	Brass and Other Alloys				
1955	614	105	589	162	1,470
1956	526	88	489	158	1,261
1957	471	78	391	142	1,082
1958	**401**	**73**	**329**	**117**	**920**

American Bureau of Metal Statistics
Excludes products of wire mills.

U. S. Brass and Bronze Ingot Shipments*

(Short tons)

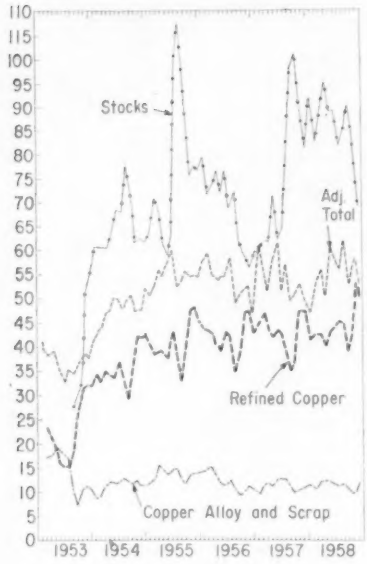
1956	288,500	1953	285,500
1957	261,400	1954	277,100
1958	**239,600**	1955	314,100

American Bureau of Metal Statistics data based on statistics from Defense Council, Brass and Bronze Industry.

*About 80% is copper.

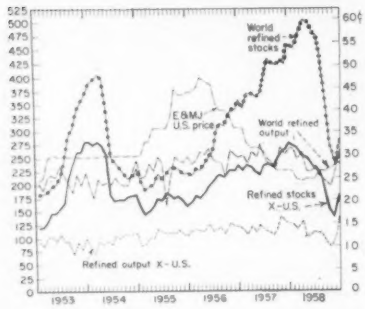
Marketing policy of major producers throughout the Free World in 1958, owing to depressed conditions, exposed two conflicting attitudes. One of these was that the decreasing market should be divided among the various sellers according to some percentage formula. A modification of this thesis was that a marketing area should be a dominant consideration in the division of business. There was some resentment of partly successful efforts to cut into what some sellers had believed to be "their" markets. Though officials of many firms held to the above views it is improbable any explicit action was taken. Government officials for a few countries in which copper is an important industry were able to be more vocal about such proposals, and suggestions were made that the United Nations take some action.

U.K. Copper Fabricating



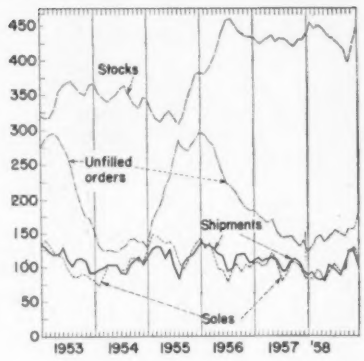
Data in thousands of long tons from British Bureau of Nonferrous Metal Statistics. All series except stocks refer to copper content of fabricated products. Refined copper and copper alloy and scrap are two month moving averages. "Adj." is the sum of the two, adjusted for seasonal variation. Stocks include refined copper held by consumers, blister copper and copper in London Metal Exchange warehouses. Data through November 1958.

Copper Output and Stocks



Copper Institute data, except price, in thousands of short tons. Exclude USSR and other countries outside the Free World. Also excluded are Japan, Scandinavian countries, Australia, Yugoslavia and Messina mine in Africa. The two series "X-U.S." are the world series less the U.S. No fabricator stocks are included. Data through December 1958.

U.S. Copper Fabricating



From U.S. Copper Association in thousands of short tons. Sales and shipments refer to copper content of products made from purchased refined copper, including copper refined by custom smelters from their intake of scrap and concentrates. Data refer to brass mills, wire mills, and foundaries. All series are for fabricated products except stocks which also include copper in process and copper in products in inventory. Sales and shipments are two months moving averages. Data through December 1958.

Most proposals for international activity to help the copper companies avoided reference to a division of markets.

The other attitude was in direct conflict. Some producers believed the division of markets or the changes in the relative amounts of copper sold should be a reflection of the differing costs of producing copper by the copper companies. These held that contraction in the market for copper should produce a contraction in output, but that high cost production should be dropped first and those firms with relatively low cost production should reduce less than the others. These firms in effect advocated that the normal adjusting mechanisms of a free enterprise capitalist economy be permitted to direct the necessary contraction of the economy to lower operating rates. They were motivated by two major considerations: 1) This policy would be better for their firms because they are low cost, and 2) the firmness and sincerity with which they were advocates of the free enterprise system. Some low cost producers may be sufficiently skeptical of the value of a free enterprise system as to support the division of markets according to an arbitrary or historical formula. But generally the cost situation of the individual firm was determinant. The attitude of governments corresponded rather closely with that of industry.

Producers also appeared to have partially solved another pricing policy problem in early 1958. They decided not to try to meet the custom smelters' price. As custom smelter and merchant prices fell, and producer prices followed, profits were squeezed for successively lower cost producer operations. Resistance by producers to price cuts stiffened. Producers decided a portion of the total market equal to the custom smelters' reduced output would be left to the smelters.

This decision, which may never have been precisely formulated and was not instituted at some predetermined time, probably marked the bottom in copper prices. Doubtless it had been done before.

Falling copper prices were less distasteful to custom smelters and merchants than to producers. Custom smelters' total cost was highly flexible. As their sales prices declined so also did their ore buying prices. Though their sales margin may not have been maintained, a declining price could in large part be passed on to their ore and scrap suppliers. They generally resisted accumulation of copper inventory and were less opposed to cutting the price of metal because the cost of ore and scrap was directly or indirectly tied to it. Metal accumulated at a relatively low price provides a better chance of eventually being sold at a profit. When sales equal intake there is no direct advantage in dropping the price. There is a tendency for custom smelters to drop the price until the point is reached where intake is equal to sales. When this point is passed and some of inventory is being sold a custom smelter is likely to raise prices so as to improve profit margins or reduce any loss that might occur from metal produced from material bought at higher prices.

Merchant sales of copper often were at lower prices than custom smelter sales. Part of the merchant sales were of metal sold them at distress prices by fabricators in need of cash. Some merchant metal was produced on toll for them from ore they bought from small miners.

One of the most significant effects of the declining prices of custom smelters (and merchants) was that it provides a partly correcting force—it becomes unprofitable to keep the higher cost mines operating or to collect some kinds of scrap, and total supply declines, reducing the need for further price cutting.

Producer costs ("producer" is normally defined as a mining firm that sells its own output in the form of electrolytic or fire refined copper or as fabricated products) have little downward flexibility. The producer may go to an adjoining and higher grade ore — sometimes a mine will purposely mine its low grade deposits when prices are high and go to high grade ore when prices fall; it may also cut overhead, reduce average wages by cutting out overtime pay and reduce purchases and waste of non-capital account material. But these are rarely significant compared with the cost cutting of a custom smelter. For producers, price cuts are often an almost direct measure of profit reduction.

Integration of the copper industries continued in 1958. A number of mining firms bought small or medium

sized fabricating companies. This move provideu further protection for mining firms in that it gave them better assurance of markets for their metal. Kennecott bought the Asarco smelter in Utah and will have a new 200,000 ton per year electrolytic refinery in Maryland ready to operate in October 1959.

Marked changes in sales policy were not made in 1958. Large producers in the U. S. continued to sell their refined copper with the provision the price would be the "seller's price on the date of shipment." Long term contracts for sale of copper to U.S. buyers ordinarily provided minimum and maximum amounts to be shipped each month. As fabricators needs dropped drastically early in 1958 the minimum amounts in some cases were probably relaxed. Contracts that were not for delivery over a series of months did not include such provisions but a regular customer could get adjustments.

Fabricators did not generally oppose "price date of shipment" contracts mainly because they changed the price of their products by a corresponding amount and effective the same day as the change in price of the copper they buy.

Custom smelters sold in the U.S. at flat prices and at the *E&MJ* domestic average. Some smelter metal could be bought for delivery many months ahead at the *E&MJ* average and at flat prices—the flat prices were ordinarily related to prices on the N.Y. Commodity Exchange and the London Metal Exchange. Most custom smelter metal was sold for delivery during the current or next following month.

Some U.S. producer metal as well as custom smelter and merchant metal was sold on the N.Y. Commodity Exchange when its prices were well above the prices in the physical metal markets.

Custom smelter sales to markets outside the U.S. were at prices existing in those markets. In the autumn, when prices in Europe jumped, U.S. custom smelters sold good tonnages there. For several months the U.S. was a net exporter of copper.

Major producers selling in Europe, except Katanga, continued to price most of their copper on the London Metal Exchange. The Chile Copper Department had intended that only about 60% of Chilean copper be sold on the LME but this restriction was not effectuated. In few cases did they receive a premium over the prices indicated by the Exchange. At times standard shapes in Europe were worth as much as 2c over LME's prompt.

Copper Mine Capacity*

(Thousands of short tons, annual rate)

United States**

	Company or mine		Capacity change	Capacity
1958				1,195
1959	Duval Sulphur:			1,200
	Esperanza		5	
1960	Kennecott: Ray		10	1,237
	Inspiration: Christmas		10	
	Duval Sulphur: Esparanza		17	
1961	Kennecott: Ray		10	1,250
	Inspiration: Christmas		3	
1962				1,250
1963				1,250

Outside U. S.**

1958				2,339
1959	Canada:	Geco	4	
		Campbell Chibougamau	1	
		Gaspe	3	
		Opemiska	9	
		Cowichan	5	
	Rhodesia:	Bancroft	30	
		Nchanga (Chingolu)	10	
		Molly Norah	5	
	Uganda:	Kilembe	2	
	Chile:	La Africana	2	
		Mantos Blancos	6	
		Braden	18	
		El Salvador	100	
		Potrerillos	—45	
	Australia:	Peko	5	
	Ireland:	Avoca	10	
	Philippines:	Atlas	4	
		Philex	3	
	Israel:	Timna	5	
	Total outside U. S.		177	2,516
1960	Canada:	Opemiska	9	
		Copper Rand	5	
		Chisel Lake	3	
		Stall Lake	3	
	Belgian Congo:	Katanga	55	
	Chile:	Mantos Blancos	6	
	Peru:	S. Peru Copper	140	
	Australia:	Mt. Isa	7	
	Total outside U. S.		228	2,744
1961	Canada:	Waite Amulet	—2	
		Opemiska	3	
		Copper Rand	5	
	Australia:	Mt. Isa	7	
	Yugoslavia:	Majdenpek	13	
	Total outside U. S.		26	2,770
1962	Canada:	East Sullivan	5	
		Copper Rand	5	
		Gaspe	—4	
	Australia:	Mt. Isa	8	
		Ravenstorpe	2	
	Rhodesia:	Mufulira	58	
	Yugoslavia:	Majdenpek	12	
	Haiti:	Halliwell	4	
	Total outside U. S.		90	2,860
1963	Canada:	Gaspe	—5	
	U. of S. Afr.:	O'kiep	4	
	Fr. W. Afr.:	Mauritania	10	
	Peru:	Cerro de Pasco	5	
	Total outside U. S.		14	2,874

*Some large copper mining firms have developed orebodies which would permit large capacity increases if demand required. Owing to this uncertainty they have suggested these not be listed.

**Some projects announced in earlier years have been abandoned or postponed to an indefinite date.

Producers, with probably one exception, continued to express the need to change from the LME as a pricing mechanism to a more stable device. They resented the wide price swings even more than the buyers. The latter priced most of their copper products so as to correspond with swings in their buying prices and therefore were not often directly hurt much by the rapid price changes. They also felt the possibility of reselling unwanted copper at the same price they paid for it gave them price protection. Occasionally they could sell it at even higher prices. There was little reselling in 1958 — producers had provisions against it. Some fabricators, including those who did a trading business in addition to fabricating, believe the LME reduces the amount of sellers' control and increases buyers' control. Copper bought at LME prices can be more easily hedged. The LME will probably remain in 1959 and 1960 as the major pricing device for producers other than Katanga selling in Europe. The latter adjusts its price occasionally according to market conditions. More often than not it will change its price on Thursday, suggesting the *E&MJ* foreign price is a significant factor in its prices. But doubtless Katanga considers all factors in changing its prices.

More than one copper market is apparent in Europe — the premiums over the LME give evidence of this. Premiums ranged from 2c down to zero and for a while there was a discount on delivery of standard shapes a few days ahead. Most fabricators buy most of their copper on long term contracts from the producers. Except when there is a prolonged strike, delivery is made rather regularly for the life of the contract—when business declines, the fabricator can usually stretch out his acceptances. Some fabricators plan to take somewhat less than their estimated needs on long term contracts. A few depend almost completely on short term buying. Occasionally these practices bring about a shortage of supply even when producer stocks are heavy—the amount of copper demanded at the LME price for immediate or nearby delivery can not be filled. The small supply of "floating copper"—metal available for immediate shipment by sellers (mainly merchants and custom smelters) that will sell spot lots—may be bid up as much as 2c over the price at which long term contract copper is being delivered.

The London Metal Exchange is not isolated from this spot market. Whether the LME price moves up or down in accordance with the premiums or in opposition to them depends on which forces are dominating the two markets. If the underlying market situation suggests the spot shortage may be short-lived, the premium may be low and the London price may rise little. The greater the length of run expected the more the whole price structure will be affected.

Strikes and the threat of strikes may accentuate "normal" price movements. All Rhodesian copper companies were

". . . Two new U.S. aluminum producers began operations in 1958. Soviet activity caused some consternation in the world market. Outlook is favorable for 1959."

Irving Lipkowitz
Assistant to the President, Reynolds Metals Co.

struck in mid-September 1958. Mining, smelting and refining ceased. This cut the supply about 38,000 short tons per month. International Nickel's mines were struck Sept. 24, reducing supply from the company's already restricted operations by about 8,500 tons per month. A strike begun Oct. 1 at Kennecott's Chino property lasted less than a month and cut output about 4,000 or 5,000 tons. During the last two weeks of September, London prices rose little. Premiums over London for standard shapes in the spot market were 1¼c and in some cases in September probably reached 1½c per lb.

Early in October, copper prices in Europe started moving up steadily. London settlement on Oct. 1 was £213¼ (26⅝c), Oct. 31 it was £252 (31½c). Three months copper acted much differently on London—it also was £213¼ Oct. 1 but on Oct. 31 it was up only to £238. Prompt copper rose £38¾ (4⅞c) but three months rose £34¾ (3⅛c).

The quick jump in London prompt copper was accompanied by the disappearance of premiums. The conviction grew that the strikes would last long and speculators who had sold contracts on the Exchange had to deliver on their contracts or follow the more usual procedure of buying offsetting contracts. In spite of heavy stocks held by producers, the fear grew that a real shortage would develop. Fabricators in the U.K. were largely dependent on Rhodesian copper and had maintained low stocks of refined metal—it was cheaper to let the producer hold stocks. It appeared copper flow would be interrupted for a long period and fabricators joined short sellers in the demand for metal. At least one major U.S. producer had sold heavily his U.S. output in that country and told U.K. fabricators he was not able to ship larger amounts of metal. With the pick-up in economic conditions in the U.S. and a demand increase by fabricators there, European consumers bought heavily but felt they needed even more as protection against a prolonged strike. Copper Institute figures show fabricators took delivery of 292,620 short tons in October (less 5,205 to the U.S. Government stockpile); of this 171,827 tons—probably a record amount—went to buyers outside the U.S. Some over bought.

Forward copper in London early in November was 2c under prompt, suggesting that when the strikes ended, prices would fall considerably. The Rhodesian strikes were settled Nov. 4; by the end of the month London prompt was down nearly 4c and prompt and forward were at the same price.

Resumption of the copper import duty by the U.S. in July 1958 contributed to the net outflow of unmanufactured copper for several months late in the year. In exchange for concessions from other countries, the U.S. copper import duty was reduced to 1.7c a lb. In addition to its application to ore, blister and refined copper it was added to the already existing import taxes on fabricated products containing copper. After imposition of the import duty, imports were off relative to a year earlier much more than they had been in the first half of 1958 and exports, including of copper refined in the U.S. from imported material, increased considerably. Such changes are not a measure of the import duty effect since other factors affected imports and exports. There is no doubt imports and exports were significantly different from what they would have been in the absence of the duty.

The lowest prices for copper in the U.S. occurred in the first few weeks of March 1958. Custom smelter copper sold at 22¾c a lb delivered to buyers' plants. The weekly weighted average custom smelter price, based on data supplied by Asarco and published in *E&MJ Metal and Mineral Markets*, was 22.350c f.o.b. refinery for the week ending March 12. The *E&MJ* weighted average price for producers and custom smelters combined reached its low point March 18 when it was 23.550c per lb f.o.b. The *E&MJ* foreign weighted average price was at the minimum of 19.375c per lb, reduced to the f.o.b. refinery Atlantic seaboard, on the last two business days of February and the first of March.

Custom smelters in the U.S. sold rather heavily at the low prices in the second and third weeks of March. Fabricators' business was not good and they took all the smelters would offer at these low prices—the 2c or greater discount from the producer price meant reduced losses or better profits for the fabricator. Failure of producers to narrow the gap set the bottom—smelters sold out their lowest price intake and by the end of March were up to about 24c delivered.

Custom smelter and average prices rose in March in the U.S. London was up about 2c by the last day of the month. In the U.S. (and in Europe) the "floating" copper—copper available for spot sale—was taken up by fabricators, permitting sellers in the spot market to move closer to the producer price. It was this absorption of copper in the spot market, and the belief producers would not drop further that was instrumental in firming the markets. Speculators—some probably were in the copper business but others may not have been—bought copper contracts, pushing up the Exchanges.

Custom smelters had a low intake of scrap in February and March and their ore intake was also low. Announcements were made that Kennecott would cut output in the U.S. in January and Chilean statements were that about 10% would be cut there; Anaconda did reduce in Chile.

The U.S. producer price of 25c delivered had clearly become the "basic" price in the U.S. The London prices were about 22¼c or a little higher—but premiums in the prompt market for standard shapes of electrolytic copper meant refined was sold at about 24c for much of March. The U.S. producer price was the stabilizing factor in the markets in the U.S. and abroad. (In January 1959 it was still that.) Prices changed little in April and May in the U.S. or abroad. The strike at Chuquicamata that began April 1 and ended in the third week of May, with a total loss of about 40,000 short tons, appeared to have no effect.

Prices in Europe began another move upward early in June. Custom smelters in the U.S. had sold well, partly on the expectation by fabricators of further price increases. Lon-

(Continued on p 242)

Nonmetallics

Potash

Nelson C. White
International Minerals & Chemical Corp.

FOR THE FIRST TIME since the Carlsbad plants were shut down by a strike in 1949, potash production by the U.S. producers failed to set a new record in 1958. Instead it decreased 3% in spite of the fact that deliveries showed an increase of 4% over the previous year. The reasons for the decline are many and varied, but they all stem from the basic fact that, worldwide, the swing from sellers' to buyers' market is now complete and the U.S. industry is subject to the fluctuations of the world market. There is instability in this market, noticeable both in the U.S. and abroad and due largely to a flattening in the use curve which has now persisted for the last three years. During the same period there has been a build-up in capacity in anticipation of the long-term growth (which is still considered certain) and operation of all facilities at as high a capacity as possible to keep unit costs at a minimum. As a result, inventories in the hands of producers have been building up steadily and in the case of the domestic industry, reached a saturation point about the beginning of 1958.

Domestic production in 1958 dropped from last year's high of 2.27-million tons K_2O to 2.2-million tons represented by 3.7-million tons of products. Deliveries increased from 2.2-million tons K_2O to 2.28-million tons. Shipments for agricultural use (94% of total) to both domestic and export markets were increased, but industrial business fell off 10%. Imports also increased, slightly overbalancing exports (.25- vs .22-million tons K_2O) and continued to represent approximately 10% of the domestic business. Principal foreign suppliers were France and West Germany with lesser amounts arriving from East Germany, Spain and Russia.

Production was reduced through planned curtailments, including reduced working schedules, layoffs and vacation shutdowns, the latter a practice new in the industry. Labor contract negotiations were long and difficult and strikes lasting from two days to six weeks stopped production at several mines, although shipping was not affected. The combined effects of the actions plus the increase in deliveries resulted in a more healthy situation in respect to inventories at the end of 1958.

The increased deliveries, although welcome, do not represent a return to the rate of growth which the industry expects to average. They do reflect some success in stopping and even reversing the recent trend toward a shipping season concentrated in the January-April period, and with deliveries in the July-December period representing less than 40% of the year's business. In 1957 a new system of pricing was established in which there were seasonal differences in prices as well as different price levels for the two popular forms of agricultural muriate. Although the first change was designed primarily to induce customers to buy in the off seasons and diminish the storage problem which the producers were experiencing, the differences were too small to cover the increased costs of storage to the buyer. All the 1958 price lists offered bigger incentives with the result that July-December shipments ran 25% ahead of the same period in 1957. Since most of the increase represents only a transfer of inventories from producers to consumers for actual use in 1959, it cannot be considered a sign of a resumption of growth in sales. Furthermore, although the first price list issued carried an increase over 1957, subsequent lists were at successively lower levels until they stabilized in mid-June at a point 8% below last year. Prices have thus dropped two years in a row and are now lower than at any time since 1942. Furthermore, contracts guarantee no increase prior to July 1960. Since most elements of costs (labor, supplies, equipment) are continuing to increase in price, the industry faces at least two years more of cost-price squeeze.

As might be expected under the circumstances, the major efforts of the industry during the year were devoted to improving operating efficiencies and reducing costs. These attempts were made more difficult by further changes in product specifications demanded by the industry's major customer, the fertilizer manufacturers.

The Carlsbad companies continued efforts to increase output per man underground. There were further advances in mechanization, principally through increased use of continuous mining machines and conveyors. No revolutionary changes were announced but there was a substantial increase in the rate of installation of belts to replace other methods of hauling. U.S. Potash Co. has completely mechanized its new mining area at Shaft No. 3 with Joy continuous miners, extensible belts and automatic skip loading. Potash Company of America, which completed a switch in 1957 to its own design of miner, added a shuttle conveyor of its own design. International Minerals & Chemical Corp., which does not use continuous miners, added more belt conveyors and experimented successfully with use of ammonium nitrate as an explosive. Further tests are continuing.

All companies continued to make changes, additions or both in their processing plants to keep up with the demand for more closely sized products. Changes included more screening, not only at the end of the process but in some instances at the beginning and intermediate points. Some additional crystallizing and compacting equipment was also installed to increase production of coarser fractions. Bonneville, however, dropped the prilled product. *(Continued)*

. . . "New sulphur projects will add substantially to the world supply. Outlook for the next few years is one of continued surplus." p 147

Charles A. Wight
President, Freeport Sulphur Co.

Potash *(Continued)*

The only substantial additions to productive capacity under way during the year were in Canada. The Kerr-McGee-Phillips-Farmers Union project at Carlsbad is still dormant so far as construction is concerned. A shaft was completed in 1957 but present work is confined to experimentation and process and plant design. Similarly, although a shaft pilot hole was completed by Delhi-Taylor in their leased area near Moab, Utah, no plans for construction have been announced. The present low price levels, reflecting surplus existing capacity, the high cost of new facilities as compared to partially written off older plants and the inherent difficulties in obtaining a sufficient share of a relatively stable market have combined to halt, at least temporarily, the addition of new companies to the list of producers.

Decisive step. The same factors certainly played a part in helping one of the existing producers take a decisive step. National Potash, the latest entrant in the field, announced in December that it had entered into an agreement with Central Farmers, big midwestern co-op, to give the latter control of its output for use or resale. As a part of the agreement, Central Farmers is offered an opportunity to buy into National (jointly owned by Freeport Sulphur and Pittsburgh Consolidation Coal) although National states it expects to retain control permanently. Central Farmers represents 10% to 12% of the domestic market for agricultural potash and through agreements with other co-ops might increase these percentages materially. National thus gives up its present share of the free market to produce a larger captive tonnage at some sacrifice in unit sales revenue. The agreement takes effect at the close of the current contract season, on July 1, 1959. Other producers will then be scrambling for the tonnages National gives up as offsets to the tonnages they will lose as Central Farmers members switch their take to National.

In Saskatchewan, however, Potash Company of America completed both its mine and refinery and began break-in operations in December. In addition, IM&CC continued work on their plant and at the end of the year had completed a shaft to 1200 ft and had most of the buildings of the surface plant completed ready for installation of equipment during the winter months. Completion of this project is scheduled for early 1960. Even these two projects are at least partially a reflection of the present situation. Basically, they are preparations for the future long-term growth which the industry is confident will occur and for which the Carlsbad reserves are inadequate. But they also are expected to provide some relief from the cost-price squeeze which has affected the industry so materially in the last two years. The extremely high-grade of the Saskatchewan deposits is expected to more than counter the difficulties inherent in mining at the greater depth required with a resulting cost of production considerably less than possible at Carlsbad. Also, the instabilities resulting from the imbalance between consumption and capacity are expected to decrease and to a great degree disappear within the next three to six years. During this time the Canadian operations will have tax benefits through depletion allowances and freedom from income taxes which will continue to help keep production costs low enough to meet competition from all comers. These points are not being ignored by other producers. Most of the other U.S. firms hold lands in Saskatchewan as do French and German interests. They are waiting only for what seems to them to be the right time to help develop the largest known reserve of high-grade potash in the world•

Vermiculite

William S. Steele
American Vermiculite Corp.

FINAL PRODUCTION and consumption figures for vermiculite in 1958 are expected to show little change over the 1957 records although wide variations in the volume of various end uses are apparent. A composite survey of 22 producing plants showed an increase of 35% in the volume of vermiculite plaster aggregate in 1958 over 1957.

Proprietary brands of vermiculite fireproofing acoustical materials, sprayed over the lower side of cellular steel floors in fireproof buildings, have been widely adopted. This method provides very substantial savings in structural dead loads, as well as in increased effective interior areas, installation time, and cost.

Powdered and finely divided exfoliated vermiculite is being used as an absorptive, inert filler in lubricants and other compositions. The use of vermiculite concrete roof decks over flat or corrugated steel sheeting, pumped in place is increasing, particularly for shopping centers and other single-story structures.

Research covering the use of vermiculite as a medium for the removal of radioactive residues in effluent solutions is continuing with promising results. Plastic bonded vermiculite as a fire resistant film or veneer coating for plywood, chip-board and other organic sheets has been developed. Vermiculaponic commercial activity is on the increase and there has been a definite upward trend in the use of vermiculite in fertilizers, pesticides and other farm uses.

U.S. Patent 2,848,976 owned by Stephen Calder, Fort Lauderdale, Fla., has been proven in a three-year test program at Ohio State University. It covers the use of South African vermiculite treated for use as a fireproof bedding for race horses; to be used at Florida tracks this year. It has been proven that vermiculite bedding has numerous advantages over organic materials and it should materially reduce fire losses

"Cobalt production and imports were down for 1958. The new hydrometallurgical plant and refinery of Union Miniere was expected some time in 1960." p 149

Hubert W. Davis
Commodity Specialist, U.S. Bureau of Mines

of both buildings and live stock. Used bedding becomes a valuable fertilizer.

U.S. Patent 2,863,841, controlled by California Stucco Products of Cambridge, Mass., is now in production. It covers a resilient playground or tennis court coating blend of vermiculite, rubber, sand, and asphalt, integrally colored.

The Vermiculite Association, Vermiculite Institute, Mandoval and Transvaal Research organizations have all expanded their programs and several new exfoliating plants are under consideration for 1959.

There is no record of new domestic vermiculite mining operations in 1958, although offerings of foreign producers from India, Argentina and the Sudan were noted. None of these appear to be commercially suitable for American consumption, from a quality standpoint.

Prices of vermiculite ore were unchanged in 1958, although some increases in the exfoliated grades were reported in certain local areas.

Prospects for 1959 indicate an over-all increase in tonnage, accentuated by new uses for the material and a continuing increased demand for aggregate and other fine grades.

American production of crude vermiculite is expected to be approximately 225,000 tons and Transvaal Ore Co., Ltd., South Africa, will turn out about 75,000 tons in 1959, which is equivalent in terms of exfoliated vermiculite volume to 100,000 tons of domestic ore.

Operations in general, throughout the vermiculite industry, were profitable in 1958•

"Barite consumption was reduced by lower activity in oil and gas well drilling. Several domestic mines were idle during the year." p 147

Reginald Rowand
Production Manager, Baroid Div., National Lead Co.

Gypsum

L. P. Larson
U.S. Bureau of Mines

Value of Private Housing

(Millions of dollars)

	1958	1957
October	$1,724	$1,586
September	1,742	1,611
August	1,718	1,571
July	1,641	1,547

BUOYED UP by an unseasonally high level of residential construction in the fall of the year, the domestic gypsum industry increased its production sufficiently to recover from losses sustained during the first few months of 1958.

Residential construction during 1958 followed a pattern different from its normal course. Normally rising in the spring to a mid-season high, construction in the past has usually tapered off or remained stable until it dropped sharply in the fall. In 1958, however, construction spurted in the spring, declined, and then began an upward spiral which continued well through fall.

Final data for residential housing starts in 1958 are expected to show a rise of 10% to 1,150,000 units from 1957 but expectations are that the upward trend will not continue (see table). Factors indicating that a leveling off period is at hand include the exhaustion of Government funds for loans, tightening of money reflecting higher interest rates, increase in vacancy rates, and a 6% decline this year in the number of families formed.

Off to a slow start in the early months of the year, output of crude increased sufficiently during the second and third quarters to bring the year to date average at the end of the third quarter up 1% over the corresponding period of 1957. About 61% of the production was from mines in five states: Michigan, 15% of the total, California (14%), Iowa (12%), Texas (11%), and New York (9%). With the exception of New York, all of the States enumerated above produce in excess of 1-million tons annually. Production of crude gypsum, based on preliminary estimates is expected to total approximately 9.5-million short tons in 1958 having a value slightly below $31-million.

Gypsum products, produced from domestic and imported ores, have about nine times the value of the crude ore from which they were made. Nearly 94% of these products valued at approximately $300-million are used by the construction industry, pre-fabricated gypsum products accounting for $230-million or 77% of the total, and building plasters at $51-million or 17%. Of the remaining 6%, 4% is sold uncalcined, for use as portland cement retarder, agricultural fertilizer and other uses, and 2% in the manufacture of industrial plasters.

Crude imports in the first eight months of the year declined 8% from the corresponding period of 1957. Imports are expected to total 4.0-million short tons accounting for about 30% of the apparent crude supply.

Disregarding pessimistic forecasts of a decline in residential construction for the years immediately ahead, the gypsum industry continued to expand and modernize its production facilities.

New plant construction and expansion has been undertaken by U. S. Gypsum Co., Bestwall Gypsum Co.

. . . *"Vanadium was down about 30% generally, but one area showed a spectacular increase; production and sale of high purity (ductile) vanadium."* p 158

G. E. Drake
Vice President, Sales, Union Carbide Metals Co.

and National Gypsum Co. The latter firm completed a new quarry at Tawas City, Mich. which includes stripping, crushing and railroad and dock facilities, during 1958.

The long-term outlook for the gypsum industry is for one of continued expansion with sharply accelerated family formation expected in the 1960's. Slum clearance, the replacement of substandard housing and new products are also expected to add to the demand for gypsum products•

Mica

Milford L. Skow
U.S. Bureau of Mines

CONSUMPTION of sheet in 1958 was below that in 1957 largely because of the decline in industrial activity. Substitution of ceramic and other materials for nonstrategic qualities of mica in electrical heating appliances was another factor in the 15% decrease in fabrication of block and film mica. Electronic applications used about 65% of the block and film mica. Consumption of splittings, principally for manufacturing molding plate and segment plate, was down about 35%. Production of mica paper reconstituted from natural mica scrap continued to increase moderately during the year.

Demand for ground mica continued high and estimated sales were only about 5% below the 96,000 short tons reported in 1957. Dry-grinding produced about 85% of the tonnage and wet-grinding, the remaining 15%.

Imports of block and film mica decreased about 10% compared with 1957, but imports of splittings were down about 35%. India continued to furnish virtually all of the film and about 45% of the block. Most of the remaining block came from Brazil. Only about 3% of the total was from other countries. Muscovite splittings were supplied almost entirely by India, and phlogopite splittings by Madagascar.

Purchases of muscovite block and film mica from foreign sources were being made by the Government through GSA under new incentive-type contracts.

A high level of production of muscovite block film, and hand-cobbed mica was maintained under the Government domestic mica purchasing program which continues until June 1962 or when the equivalent of 25,000 short tons of hand-cobbed mica has been purchased. By the end of 1958 an estimated 16,000 short tons had been accepted toward the quota. A revision of the purchase regulations incorporated numerous accumulated amendments and liberalized the calculation of payments for the hand-cobbed product.

Until its expiration on June 30, DMEA in 1958 furnished financial assistance in exploration for strategic mica on 26 active projects, 12 of which were new contracts executed during the period.

OME succeeded DMEA in administering remaining contracts and prepared to negotiate new contracts with Government participation set at 50% of authorized costs (vs. the former 75%).

Synthetic mica, principally for use in glass-bonded mica ceramics, continued to be produced by Electronic Mechanics, Inc., Clifton, N. J., and Synthetic Mica Division, Mycalex Corp. of America, West Caldwell, N. J. This material still is not a substitute for strategic grades and qualities of natural mica. However, spacers for a special type of electronic tube are being punched by Electronic Mechanics, Inc., from the larger single crystals of synthetic mica recovered in the production of synthetic mica flake.

Research on development of reconstituted synthetic mica sheet suitable for use in electronic applications continued with eight contracts in force at the end of 1958 under the 5-year, industry-Government program for development and evaluation of substitutes for strategic natural mica. During the year Battelle Memorial Institute, Columbus, Ohio, completed its one-year contract, and new contracts went to Horizons, Inc., Cleveland, Ohio, and the National Bureau of Standards. Other contracts in force during the year were with the Federal Bureau of Mines, Norris, Tenn., Frankford Arsenal, Philadelphia, Pa., General Electric Co., Pittsfield, Mass., Arthur D. Little, Inc., Cambridge, Mass., Sylvania Electric Products, Inc., Flushing, N. Y., and Synthetic Mica Division, Mycalex Corp. of America, West Caldwell, N. J. Satisfactory techniques for delaminating synthetic mica have been developed, and studies now are focused on finding a method of bonding the flakes into a sheet which would contain the desired adequate electrical and mechanical properties•

Mica Statistics

(Thousands of pounds)

	1958 estimated	1957
Imports:		
Block:		
India	1,380	1,548
Brazil	1,670	1,867
Other	94	92
Total	3,144	3,507
Film:		
India	155	149
Other	1	1
Total	156	150
Splittings:		
Muscovite	5,400	8,580
Phlogopite	550	611
Total	5,950	9,191
Consumption:		
Muscovite block and film:		
Good Stained or better	120	152
Stained	1,450	1,645
Lower than Stained	1,350	1,528
Total	2,920	3,325
Splittings:		
Muscovite	4,800	7,531
Phlogopite	350	506
Total	5,150	8,037

"When interest in chrome ore shipments revive, the picture will be changed. Rhodesian transportation has improved, Turkish exports may increase, Russian pressure will strengthen." p 151

Norbert Blechner
Vice President, Associated Metals & Minerals Corp.

Feldspar

Taber de Polo
U.S. Bureau of Mines

PRODUCTION, which lagged behind the 1957 rate considerably for the first six months of the year, increased in the latter half of 1958 and total output was close to the 1957 figure. General improvement in business, especially the increased building rate, was the major factor. The quantity of feldspar used for sanitary ware, tile, and enamel held its own compared to 1957.

Increased use of nepheline syenite has been a competitive factor in the domestic feldspar market. Two large nepheline syenite producing companies in Canada expanded research to widen the range of application, and the use of nepheline syenite will continue to increase. Continued imports of large quantities of foreign pottery also were a limiting factor in expanding the feldspar market.

There was an additional small drop in the price of glass-grade feldspar to $9.80 per ton f.o.b. producers' plants in the North Carolina area. This price cut and a petition to secure a reduction in rail freight rates were measures being taken by the feldspar industry to meet the increased competition from nepheline syenite.

Following completion late in 1957 of the new plant of Lawson-United and Minerals Co. at Minpro, N. C., and the plant of Spar-Mica Corp., Ltd., of Canada, an affiliate of Golding-Keen Co., of Trenton, N. J., the milling capacity of the feldspar industry became twice the demand. Destruction by fire in June 1958, of the Custer, Wyo., feldspar-grinding mill of the Consolidated Feldspar Dept., International Minerals & Chemical Corp., caused regional shortages of high potash feldspar. The plant is being rebuilt.

Ground feldspar imports from Canada, concentrated by high intensity magnetic separators and electrostatic machines, increased in 1958.

The proportion of the feldspar produced by flotation in Georgia, North Carolina, and Tennessee has increased in recent years and in 1958 constituted about 80% of total feldspar production from the area and close to 60% of total U. S. feldspar production. This trend will undoubtedly continue. Commercially valuable by-products, silica sand and flake mica, are produced when recovering feldspar concentrates by flotation.

Production of aplite, another feldspar substitute, decreased appreciably in 1958 over 1957•

Fluorspar Statistics

(Short tons)

	1958 estimated	1957
Domestic Shipments[1]:		
Acid grade	**169,000**	189,800
Ceramic grade	**22,000**	29,800
Metallurgical grade	**129,000**	109,300
Total	**320,000**	328,900
Imports for Consumption[1]:		
Containing more than 97% CaF_2	**250,000**	[3]412,300
Containing not more than 97% CaF_2	**100,000**	219,100
Total	**350,000**	[3]631,400
Domestic Consumption[2]:		
Hydrofluoric acid	**254,000**	328,700
Glass and enamel	**35,000**	37,400
Steel	**169,000**	243,100
Iron foundry	**14,000**	15,400
Other	**13,000**	20,100
Total	**485,000**	644,700

[1]Includes Government purchases.
[2]Material entered bonded warehouses during 1955–1956, and withdrawn from bonded warehouses in 1957 included.
[3]Excludes Government purchases.

Fluorspar

Robert B. McDougal
U.S. Bureau of Mines

AN OVER-ALL DOWNWARD trend in the fluorspar industry was experienced during 1958, largely resulting from the economic recession felt throughout the U. S. in late 1957 and early 1958. Government purchases were a factor in maintaining domestic production; however the purchase program initiated in mid-1956 terminated at year's end.

Domestic production of acid-grade fluorspar totaled about 173,000 short tons and shipments amounted to nearly 169,000 tons valued at an estimated $10-million. Acid-grade imports for consumption declined considerably from the previous year despite the adjustments made in 1957 for acid-grade material entered in 1955-56 but not recorded by the Census Bureau until 1957.

Metallurgical-grade fluorspar production increased substantially over 1957 owing to the Government's buying program for this grade, whereas shipments of ceramic-grade fluorspar declined during the corresponding period.

Illinois, supplying about 44% of the total domestic output, was again the leading producing state in 1958, although production was below the previous year's output. The production of fluorspar—all metallurgical grade—in Montana and Utah increased noticeably over the output in 1957, as did acid-grade production in Colorado. Production in Kentucky was up from 1957. Fluorspar production in Nevada during 1958 dropped below the 1957 output. Some acid-grade fluorspar was produced in California and metallurgical grade was reported shipped from Arizona. About midyear H. Evans Roberts, partner in the Montana operation, reportedly had leased a mill in Deming, N. M. and was planning to concentrate ore from that area. Another mill was reported to be planned for the Deming locality later in the year and would receive its requirements from a greater area in New Mexico.

Public Law 733, the Domestic Production and Purchase Act of 1956, which authorized in part the purchase of 250,000 short dry tons of acid-grade fluorspar at a base price of $53 per ton expired on Dec. 31, 1958. Congress passed legislation to extend the program for one year; however, this legislation was vetoed by the President. As of Dec. 31, approximately 161,000 tons had been contracted for under the PL 733 program.

On June 30, awarding of further contracts for the purchase of metallurgical-grade fluorspar for the strategic stockpile were terminated. Deliveries under contract entered into prior to June 30 will continue at a reduced rate to September 1959.

The termination of the two programs eliminates the Government as a direct factor in the domestic fluorspar market. The barter program conducted by the Department of Agriculture under PL 480 will probably continue to be an important element in fluorspar in 1959.

In October, the Domestic Fluorspar Producers Association applied to the

"Satisfactory techniques for delaminating synthetic mica have been developed. Eight Government research contracts remained in force at year end to develop substitutes for strategic natural mica." p 142

Milford L. Skow
Commodity Specialist, U.S. Bureau of Mines

U. S. Tariff Commission under Section 7 of the Trade Agreements Extension Act of 1951, as amended, for an investigation regarding acid-grade fluorspar. The Commission found that the application was premature and that an application would be appropriate only after the Government had terminated its purchase programs and an opportunity has been had to observe the developments for a reasonable period thereafter.

Trade journal price quotations for the various grades of fluorspar, both domestic and foreign, remained stationary throughout 1958. These prices, depending upon grade, have shown little or no fluctuation since mid-1956 when the Government purchase programs for domestic fluorspar apparently stimulated the rise in prices.

Consumption in 1958 was below that in the previous year when a record of 644,700 tons were consumed but was above the 1954 low of 480,400 tons. Hydrofluoric acid plants consumed nearly 23% less fluorspar than the previous year, reflecting the decrease in the production of primary aluminum and the requirements of synthetic cryolite and aluminum fluoride. Similarly, consumption of fluorspar at steel plants was down about 30% from the previous year.

It was estimated that for the first nine months of 1958, 4.1 lb of fluorspar were consumed to produce one short ton of basic open-hearth steel. In 1957 an average of 4.2 lb of fluorspar was consumed per short ton of basic open-hearth steel. The total consumption of fluorspar in other industries decreased slightly, though there were several industries in which an increase was noted.

The domestic industry has expressed apprehension over the outlook for fluorspar in 1959. Acid-grade fluorspar production may decline following the end of PL 733. Sales volume to consumers is unpredictable as it depends in part on industrial activity and in part on the competitive position of domestic versus imported fluorspar•

Phosphate

Finn B. Domaas
Assistant Editor

MARKETABLE PRODUCTION of phosphate rock sold or used in the U.S. increased 4% and 3%, respectively, during the 1958 crop year (July 1, 1957 to June 30, 1958) over the crop year ending June 1957, according to the U.S. Bureau of Mines.

The same 1958 crop year report stated that all three producing areas—Florida, Tennessee, and the Western States—again set new records in the total phosphate rock sold or used in the year ending June 30, 1958.

The 1958 end-of-year preliminary estimate of marketable production of domestic phosphate rock is 14.63-million long tons valued at $91.8-million, compared with 13.98-million long tons valued at $87.69-million in 1957, according to E. R. Ruhlman, commodity specialist, branch of ceramic and fertilizer materials, USBM.

"No definite information," said Ruhlman, "is available on phosphate rock consumption. In general, agricultural consumption was up slightly. The use of ordinary superphosphate was down 2 or 3% but the use of wet-process phosphoric acid and triple superphosphate was up—especially wet-process acid."

Production of elemental phosphorus is down about 3% based on 10 months figures compiled by the Bureau of the Census.

The over-all 1958 consumption of phosphate rock in the U.S. is probably up about 2% over 1957.

Increased foreign competition during 1958 is one of the problems currently facing some of the exporters of U.S. phosphate.

U.S. developments in '58. American Cyanamid Co., Brewster, Fla., in reply to an *E&MJ* survey, noted that a major development took place in its acid production with the marketing of an extremely low solids content acid for consumption by fertilizer formulators.

Davison Chemical Co. (Div. of W. R. Grace & Co.), will exhaust its Pauway (Fla.) deposit in the next few years and the company will then begin mining the Clark-James deposit.

At George Relyea's Garrison, Mont., operations, a 1,000 ft tunnel will be driven to a deposit that will yield an estimated 660,000 tons of material.

International Minerals & Chemical Corp., basic producer of phosphate and potash fertilizer materials, is after a stronger position in consumer markets. IMCC is forming a lawn and garden department in its Plant Food Div. to promote a new lawn fertilizer called Thrive. Thrive will be merchandised around the theme that it has "a unique slow-release feature to provide balanced and metered year-round feeding."

Swift & Co. is expanding the triple superphosphate plant at its Bartow, Fla. mine.

All producers are putting more and more emphasis on improving the efficiency of operations, and are studying the benefits of an industrial engineering program.

In voicing the industry-wide cost-cutting awareness, J. R. Simplot Co., Pocatello, Idaho, said that "we are vitally interested in methods of evaluating equipment and manpower performance. This includes such items as maintenance, equipment replacement, employer-employee relationships, time studies, operating conditions, such as road construction and maintenance, etc."

In the latter area, Monsanto Chemical announced that its major development in 1958 was to begin construction of a privately owned mine haul road at the company's Idaho operations. The road will allow Monsanto to use 100 ton gross weight trucks, getting away from state limitations and thereby reducing hauling cost. Monsanto expects to have the road finished by July. The hauling units, combination tractor and a trailer, will be high speed, the net weight of the ore per load will be 75 tons•

Asbestos

Walter A. Rukeyser
Consulting Engineer

OVER-ALL SHIPMENTS of chrysotile from the Province of Quebec through October of last year show a decline of one-sixth from 1957. But how much of this decline was due to the general economic recession in the U.S. and how much to rising competition from other districts is a moot point.

First, there is the erratic distribution of the reduction in shipments by grades: one-fifth in the crudes, one-third in spinning fibers, over one-quarter in shingle stocks, less than one-eighth in paper, one-fifth in Group 6 and about one-ninth in Group 7. Next there is the U.S. Gross National Product which, it is estimated, will show about $436-billions for 1958 compared to $433-billions for the preceding year; a slight gain to be sure, but still a gain. Yet in 1956, when the GNP was $412-billions, Quebec asbestos production was in the neighborhood of 1-million tons compared to a like figure for 1955 and 1957—and opposed to an estimated 900,000 for all Canada in 1958. Lastly, new-home starts in the U.S. for 1958 are estimated at well over 1-million, a 10% increase over 1957, an index factor again counter to the trend in Quebec shipments.

While shipments were dropping in the world's foremost asbestos producing area, business seemed to be brisk elsewhere. Cassiar, from British Columbia, anticipated a $9-million gross for '58 compared to $8.3-million for '57—all in the spinning and shingle grades. This appears to be about 10% of the $90-million estimated as the 1958 total for all Canada. On the other hand the Union of South Africa reports exports for the first half year at 71,435 tons (of which 27,665 were amosite, 9,775 crysotile, 27,295 Cape Blue and 6,700 Transvaal Blue). The Union's production for the April-June quarter was 44,402 tons of all varieties, of which 3,283 were used at home, indicating an annual rate of over 175,000 tons. This compares with 94,817 for 1953, 119,699 for '55 and 136,520 for '56.

In *E&MJ*, February 1953 the writer reported 800,000 tons as the estimated chrysotile output of the Soviet Union. This figure was corroborated during 1958 by the fiber-sales manager of a large U.S. corporation upon his return from Europe. Russia's exports to only six western European countries, for the first six months of 1958 are given as: France 28,000 tons, Belgium 17,000, Holland 2,000, West Germany 13,000, Austria 4,000, Italy 5,000. The total for the first half of 1958 is thus 69,000 tons and does not take into account shipments which are known to be going behind the Iron Curtain, to the rest of Europe, South America and Asia. Still another indication of a possible trend away from Quebec asbestos is the comparatively small but rising production from Australia and Venezuela (15,000 tons in 1958 of asbestos-cement grades from Amveco).

The above figures are doubly impressive when analyzed as to grades. Only in Quebec is any quantity of the cheap Group 7 fiber produced, and the tonnage of milled fibers still accounts for only about one-third of the total Quebec tonnage. Opposed to this is the fact that in all the other producing areas mentioned above, the bulk of the output falls into the relatively expensive milled fiber categories —especially the asbestos-cement grades. And the 1958 developments in Quebec would only appear to

Canadian Shipments and U. S. Gross Product

(12-month period, short tons—Quebec, Ontario, B. C.)

	1958 estimated	1957	1956	1948	1938
Crudes	**500**	622	717	977	2,911
Spinning, shingle, paper	**305,000**	404,016	392,983	241,953	163,097
Shorts, etc.	**600,000**	641,448	620,549	473,839	123,785
Total all grades shipped	**905,500**	1,046,086	1,014,249	716,969	289,793
Produced	**910,000**	1,045,086	1,043,051	—	—
Value (shipped)	**$90,000,000**	$104,489,431	$99,859,969	$42,231,475	$12,890,195
Av. fiber price per ton	**$99.50**	$100	$98.30	$58.90	$44.40
U.S., gross product (billions)	**$436**	$433	$412	$225	$90
Canada asbestos shpts. (mils.)	**90.0**	104.5	99.9	42.0	12.9

Canadian Asbestos Exports

(Short tons)

	10 months		October	
	1958	1957	**1958**	1957
Crude	**373**	529	**15**	112
Milled fibers	**253,740**	320,480	**35,676**	46,398
Waste, refuse, shorts	**448,987**	534,816	**56,739**	57,723
Total	**703,100**	855,825	**92,430**	104,233

Canadian Asbestos Shipments by Grades

(Including any for own use—short tons)

	10 months		October	
	1958	1957	**1958**	1957
Quebec Only				
Crude—No. 1, No. 2, Other	**420**	528	**22**	44
Milled—Group 3 (Spinning)	**15,647**	23,274	**1,857**	2,047
Group 4 (Shingle)	**140,277**	190,412	**20,113**	19,467
Group 5 (Paper)	**77,964**	88,271	**10,441**	7,787
Group 6 (Stucco)	**110,600**	136,201	**14,331**	14,346
Group 7 (Refuse)	**353,318**	397,868	**46,027**	39,775
Group 8 (Sand)	**14,090**	20,815	**721**	1,186
Total, all grades	**712,316**	857,369	**93,512**	84,652
CANADA (Quebec, Ontario, B. C.)	**755,478**	902,127	**98,392**	88,991

"Molybdenum production and consumption are expected to increase in 1959. Output of molybdenum powder might double the 1958 figure in response to demand." p 150

Wilmer McInnis
Commodity Specialist, U.S. Bureau of Mines

Canadian Asbestos Mining Costs

(Except plant replacement, renewal, expansion, ore depletion)

	1957	1956	1955
Labor and employees	**$32,283,287**	$30,411,878	$28,116,049
Fuel and electricity	**6,008,420**	5,541,309	5,117,137
Supplies and containers	**14,558,214**	12,335,772	11,180,264
Taxes (all)	**12,057,534**	11,674,042	9,240,496
Workmen's compensation	**624,513**	504,664	392,692
Silicosis and unemployment insurance	**2,579,752**	515,481	184,824
Total	**$68,111,720**	$60,983,146	$54,231,462
Tons mined	**22,610,743**	21,922,874	17,696,357
Tons milled	**14,096,117**	13,740,326	12,427,002
Gross profit	**$36,377,711**	$42,321,163	$45,409,636
Profits per ton milled	**$2.87**	$3.09	$3.65
Profit to sales	**35%**	42%	45%

Prepared with data from the Mineral Statistics Section, Industry and Merchandising Division, Dominion Bureau of Statistics, Ottawa.

worsen the competitive picture wherein it is now (1959) estimated that on a 300 days per year operating basis the annual potential is in excess of 1.5-million tons, of which 600,000 tons of Groups 1 through 5 would have to be sold competitively to keep the mills running full time at 100% capacity.

In Quebec, 1958 virtually saw the final fulfillment of the various expansion plans which first began to be formulated as far back as 1944. It was in the fall of that year that the Flintkote Co. of New York decided to acquire its own source of supply. Studies were completed by the end of the year; its present property purchased in January 1945 and production commenced in June 1946. That year also saw the beginning of development of a property nearby by Bell; development which proved a large tonnage and a comparatively high proportion of grades 4, 5 and 6. This is the property, which later, sold to a wholly-owned subsidiary of National Gypsum Co. of Buffalo, N.Y., went into production in 1958 with a new, ultra-modern 3,000 tpd mill. The same year, 1946, also saw the start of exploration of the property under Black Lake by the company to be known as United Asbestos. In 1958 a mill rated at 5,000 tpd commenced production (after the expenditure of over $36-million) from an open-cut operation made possible by the drainage of the lake now under the ownership of Lake Asbestos, a wholly-owned subsidiary of American Smelting & Refining. The past year also saw the completion of the 2,000 tpd plant of Carey-Canadian on a new discovery, rich in shorts, northeast of East Broughton with the attendant closing of the company's old 1,000 tpd mill at East Broughton. Since the Lake plant has been described as "generously designed" its actual capacity is said to be 6,000 tpd, so an additional 10,000 tpd of mill capacity has been added to the district's potential.

The past year, likewise, has witnessed the virtual completion of the Asbestos Corp.'s modernization program. The new Beaver mill's first unit was placed in production last August; the King mill being dismantled and its equipment, up-dated, moved into the new plant as a second unit. When it is put on stream it will take the combined tonnages from the Beaver and King mines. This will give the corporation three mills, each now rated at 5,000 tpd—the new Normandy, the new Beaver-King and the modernized British-Canadian at Black Lake.

The rated output of Lake Asbestos is slightly over 100,000 tpy fiber falling almost wholly in the milled fiber category. National's plant, operating ore of a grade superior to the district's average, should be able to produce well over 50,000 tpy of mainly Groups 4-6 fiber. Carey-Canadian, with ore reported to carry as high as 25%, mainly in the "short" grades, should be able to produce conservatively a like amount of fiber. Thus 20% has been added to the maximum amount of shipments ever made from the district. However, the new potential in Groups 4-6 fibers is inordinately higher than that figure. Thus, using the average fiber content for the year 1957 as a norm, viz. 8%, and with a daily milling capacity for Quebec alone of approximately 60,000 tons, a potential production of about 1.5-million tons today seems a conservative estimate for Quebec. In view of rising competition from Russia, Africa and elsewhere in Canada, just when the market will be able to absorb the total Quebec potential seems open to question.

Quebec's competitive situation is further aggravated by ever-increasing costs; steadily increasing wages and fringe benefits; mounting ratio of rock mined to rock milled; charges for overburden removal, or underground development for mines past the economic limits of open-cut mining; higher taxes as new-mill exemptions from Federal income tax terminate and higher cost of unemployment insurance ($2,555,487 in 1957 opposed to only $212,030 in '56). See tables.

Outside of Quebec only one reported major development project was still at open-end as 1958 closed. This relates to the properties at Baie Verte, Newfoundland of Advocate Mines Limited wherein previous reports set the developed ore tonnage in excess of 20-million, with a relatively high percentage of asbestos-cement grades somewhat harsh in texture. Now it appears that at least an additional $1-million will be spent to further explore the deposits. These funds are to be made available by a group which includes Patino Limited of Canada, Amet Corp., Inc., Financiere Belge de l'Asbestos-Ciment, S. A. and Canadian Johns-Manville. The last named company has contracted to manage and operate the property with the technical assistance of its associates. Present plans call for a development program which would take some two years to accomplish with mill and ancillary plant construction requiring an additional 18 months. Initial rock capacity is stated

to be 3,000 tpd. The property will enjoy a short sea-haul to Europe compared with the Quebec mines. Fiber will be shipped from Baie Verte in ocean-going cargo ships direct. Such a rate of production would add another 50,000 tpy fiber potential. According to J-M officials' statements to the press, it is believed from studies made by their company that, in the three and one-half years further work now planned before the property commences production, the "world-wide demand for asbestos fiber will absorb Canada's output of asbestos including Newfoundland's. . . ."

There have been no changes in Canadian sales' prices since the raise of October 1957•

Barite

Reginald Rowand
National Lead Co.

U.S. Barite Consumption

(Thousands of tons)

1953	1,149
1954	1,216
1955	1,460
1956	2,035
1957	1,671
1958 estimated	**1,200**

U.S. CONSUMPTION in 1958 decreased in comparison with recent years due primarily to less activity in the oil and gas well drilling industry. In 1958 it is estimated that 890,000 tons of domestic barite will be sold or used as compared with 1,152,882 tons in 1957. Imports for 1958 are estimated at 530,000 tons, compared with 832,626 in 1957.

About 85% of domestic consumption is used as a weighting material in oil and gas well drilling fluids. In the latter part of 1957 drilling was curtailed and depressed activity continued in 1958, resulting in a greatly reduced demand for barite in a highly competitive market.

Several major domestic mines and plants were idle during part of 1958, with production confined to only those sources that had the most favorable production and transportation costs. Most of the ground barite used in drilling is consumed in the Louisiana and Texas Gulf Coast areas. Because of high rail transportation costs the domestic barite supply to this area was limited almost entirely to nearby sources in Arkansas, Missouri and Georgia.

Imports for processing at Gulf plants were reduced, although ocean freight rates on barite ore were at their lowest level in many years.

Western barite sources located in California, Idaho, Montana and Nevada continued to supply the west coast and Rocky Mountain markets. Although some deposits in the western states contain substantial reserves, transportation cost prohibits their use in the major consuming areas.

Ground barite consumed by other than the drilling industry was used in the manufacture of lithopone, barium chemicals, glass, paint, rubber, concrete for atomic shielding and various other products.

Arkansas again led in domestic barite production, followed by Missouri, Georgia and Nevada. Other producing states are California, Idaho, Montana, New Mexico, South Carolina, Tennessee and Washington. The U.S. produced approximately 40% of the world's barite, followed by West Germany, Mexico and Canada.

Prospecting for new deposits declined in 1958. The search continued for foreign deposits to supply accelerating demand by the drilling industry in certain foreign areas and also for utilization as sources of competitive low crude for importation to the U.S.

The future of the barite industry is dependent primarily on future activities in oil and gas well drilling•

Sulphur

Charles A. Wright
Freeport Sulphur Co.

U.S. Sulphur Production

(Thousands of long tons)

	1958 estimated	1957*
Frasch sulphur	**4,650**	5,490
Other elemental		
Recovered	**630**	510
Other native	**20**	85
Sulphur in pyrites	**400**	435
Sulphur in gases	**500**	480
	6,200	7,000

*U. S. Bureau of Mines.

U.S. PRODUCTION of sulphur declined in 1958 for the second consecutive year. The cutback was the result in part of the recession and increased imports, but more significantly it was due to a major reduction in the stockpiling rate of Frasch sulphur.

Lessened business activity in such major consuming industries as steel, rubber and textiles caused a drop in the use of sulphur. The decrease, however, was limited to a few percentage points by the relatively good year experienced by the phosphate fertilizer industry and by some segments of the chemicals industry, two of the largest consumers of sulphur. A general increase in demand near the end of the year, although reassuring, was insufficient to bring the annual rate to the level achieved in 1957.

On the basis of preliminary data, it is estimated that production of sulphur from all sources in the United States amounted to 6.2-million long tons, compared with 7-million tons in 1957. Frasch production was about 4,650,000 tons, compared with 5,490,000 tons the previous year.

Output of the Louisiana mines was about 2,055,000 tons, virtually the same as in 1957, while the mines in Texas produced 2,595,000 tons, down 770,000 tons. This drop was accounted for largely by a change in stockpiling policy. In 1957, the aboveground reserves of Frasch sulphur were increased by 456,000 tons, but in 1958 no significant additions were made.

Of the balance of output, 630,000 tons represented elemental sulphur from refinery gases and sour natural gas; 20,000 tons elemental sulphur from native deposits; 400,000 tons sulphur contained in pyrites; and 500,000 tons sulphur in various forms from other gases.

Demand for Frasch sulphur from abroad helped to bolster the industry's

"Most U. S. potash firms hold lands in Saskatchewan, as do French and German interests. Development of the world's largest reserves is pending." p 139

Nelson C. White
Vice President, Potash Division
International Minerals & Chemical Corp.

U.S. Sulphur Recovery Projects Completed or Under Construction—1958

(Long tons)

	Estimated annual capacity	Gas source
American Oil Co., Yorktown, Va.	17,500	Refinery
Anlin Co. of New Jersey, Perth Amboy, N. J.	12,000	Refinery
Magnolia Petroleum Co., Beaumont, Texas	24,500	Refinery
J. L. Parker, Andrews County, Texas	8,750	Natural
Pan American Petroleum Co., Cottonwood Creek, Wyoming	7,000	Natural
Socony Mobil Oil Co., Paulsboro, N. J.	42,000	Refinery
Total	111,750	

business during the year. Shipments totaled an estimated 1,575,000 tons, slightly more than those made the previous year and only 75,000 tons below the high in 1956. Acid producers throughout the Free World are continuing to build plants utilizing elementary sulphur, as opposed to pyrites, wherever feasible. Influencing their choice is the assurance of plentiful, low-cost elemental sulphur from the Frasch industry in the United States and Mexico and from the recovery of sulphur from natural gas in France and Canada.

In mid-1958 the four U.S. Frasch sulphur producers established the Sulphur Export Corp. to sell outside the North American continent. The step was taken in order to meet more effectively the increased competition abroad from foreign sources and to deal more effectively with foreign buying combines. The jointly owned company was created under the terms of the Webb-Pomerene Act, which since 1918 has permitted companies within an industry to form a single organization to transact business overseas.

While the U.S. was the largest exporter of elemental sulphur in the world last year, it was at the same time the largest importer. Incoming shipments rose to an estimated 767,000 tons in 1958, compared with 669,000 tons in 1957. Imports of Frasch sulphur from Mexico were up 110,000 tons to 600,000 tons, and imports of Canadian sulphur—160,000 tons contained in pyrites and about 7,000 tons recovered from sour natural gas—showed little change.

Competitive factors kept the price at depressed levels throughout the year. The quoted price for both domestic and export shipments was $25 a long ton f.o.b. port, unchanged since the reduction from $28 a ton effected in September 1957.

One new Frasch mine was placed in production in 1958. This was the Fannett, Texas, property of Texas Gulf Sulphur Co., the world's largest producer, which has three other mines in the state. Freeport Sulphur Co., the second-largest producer, has four mines in Louisiana; Jefferson Lake Sulphur Co. has two in Texas and one in Louisiana; and Duval Sulphur and Potash Co. has one mine in Texas.

Two new U.S. salt dome deposits were under development, both projects of Freeport Sulphur. The largest is Grand Isle, a discovery of major magnitude located off the Louisiana coast in 50 ft of water seven miles from the nearest land. The second, known as Lake Pelto, is situated some miles away in the shallow, partially protected water along the coast. At Grand Isle, a steel structure measuring nearly a mile in length was nearing completion at year's end, and production is expected in 1960.

There were six new projects to recover sulphur from other than salt dome deposits completed or under construction in the U.S. As shown in the accompanying table, the total new productive capacity is estimated at about 100,000 tons annually.

There were numerous new projects elsewhere in the Free World. Mexico's fourth Frasch plant was under construction by Texas International Sulphur Co. at Texistepec with an announced daily capacity of 1,000 tons. The existing mines, which last year produced an estimated 1.2-million tons are the Jaltipan property of Pan American Sulphur Co., Amezquite of Gulf Sulphur Co., and Nopalapa of Texas Gulf Sulphur. The year's shipments, which totaled approximately 1.1-million tons, were made entirely by Pan American and Gulf Sulphur.

In France, the Societe Nationale des Petroles d'Aquitaine added 280,000 tons of new annual capacity at its facilities which recover sulphur from sour natural gas at Lacq. This expansion is a part of the company's announced program to increase production to 1.3-million tons by the early 1960's.

In Canada, four new facilities or expansions were under way or completed in 1958. The largest is the addition of 156,000 tons of annual capacity at British American Oil Co.'s Pincher Creek plant which recovers sulphur from natural gas. The other projects, which will add a total of about 170,000 tons of new annual capacity, are those of Texas Gulf Sulphur at Okotoks (natural gas); Laurentide Chemical and Sulphur Co. at Montreal (refinery gas); and Steelman Gas Ltd., at Estevan (flare gas from oil production).

Other projects in the Free World will add new annual capacity of about 75,000 tons. They are: British Petroleum Co. and Esso Petroleum Co. in England; Chinese Petroleum Corp., Taiwan; Idemitsu Kosan Co., Japan; and projects of Standard-Vacuum Oil Co. in Australia and South Africa.

There are in addition at least two pyrites projects reported completed in 1958. These are St. Patrick Copper Co.'s Avoca mine in Ireland, and the major expansion in capacity by Dowa Mining Co. Ltd. in Japan.

Outlook. With the markets for sulphur already saturated and with production considerably below capacity levels, the outlook for the immediate term of the next few years is one of continued surplus. The many new projects together with those planned to remove the sulphur from the gas supplying existing pipelines will add substantially to the Free World sulphur supply. For the long term, however, an enormous growth in demand is anticipated on the expectation that world consumption will continue to increase at a rate at least equal to that of the past. Over the last half century this increase has averaged 3½% to 4% a year. As a consequence, there will be a need in the long run for production of sulphur even greater than any now foreseen•

Ferroalloy Metals

Cobalt

Hubert W. Davis
U.S. Bureau of Mines

Cobalt Statistics

(Pounds)

	Metal 1958		Oxide (gross wt) 1958	
	9 months	1957	**9 months**	1957
U. S. production	**2,653,993**	4,514,885	**233,052**	594,690
U. S. imports	**10,813,310**	16,240,327	**552,280**	646,750
Belgium-Belgian Congo	**7,791,704**	10,020,507	**509,170**	646,550
Canada	**867,032**	2,230,672	**43,110**	–
West Germany	**474,700**	918,700	–	200
Norway	**539,263**	761,775	–	–
United Kingdom	**211**	1,732,540	–	–
Northern Rhodesia	**1,126,300**	530,000	–	–
Price per lb	**$2.00**	$2.35–$2.00	**$1.52**	$1.78–$1.52

(Co content in pounds)

	1958 9 months	Percent change
Production:		
Salts	**237,264**	+ 7
Driers	**495,648**	+ 5
Hydrate	**66,877**	−44
Shipments:		
Salts	**232,630**	+ 1
Driers	**496,015**	+ 6
Hydrate	**97,789**	−22

FREE WORLD PRODUCTION of cobalt declined for the second consecutive year. Production is estimated at 14,000 short tons in 1958, compared with 15,500 tons in 1957.

U.S. imports in the first nine months were 15% less than during the corresponding period of 1957. Receipts of metal from Belgium and Belgian Congo were up 11%, but less was received from Canada, Norway, West Germany, and United Kingdom. Noteworthy was the receipt of 1.1-million lb of metal from Northern Rhodesia; in addition to this quantity, a substantial amount of metal refined in Belgium from cobalt matte produced in Northern Rhodesia is included in the import figure for Belgium. Imports of oxide, chiefly from Belgium, increased 18%. Imports of white alloy from Belgian Congo ceased after May 1957.

U.S. Supply. Production of cobalt metal for nine months was 28% less than in the corresponding period of 1957 and imports dropped 10%. The decline in production of metal was due to the shutdown of the refinery of African Metals Corp. at Niagara Falls, N. Y., in October 1957. Production of oxide declined 55% but imports increased 18%. Production and shipments of salts and driers during the first nine months are shown in the table.

Consumption was 5.2-million lb during the first nine months compared with 7.2-million lb in the corresponding period of 1957. Cobalt-chromium-tungsten-molybdenum alloys represented 33% of total consumption, but the quantity used was 32% less than in 1957. Magnet alloys took 28% (down 34%).

Concentrate producers from domestic ore were Bethlehem Cornwall Corp. in Pennsylvania, Calera Mining Co. in Idaho, and National Lead Co. in Missouri. Production (cobalt content) was 3.95-million lb during the first 10 months, compared with 3.43-million lb in the corresponding 1957 period.

Garfield (Utah) refinery of Calera Mining Co. produced 7% more cobalt metal in the first 10 months than in the corresponding period of 1957. National Lead Co.'s refinery at Fredericktown, Mo., produced 31% more metal in the first 10 months than in the corresponding period, and output of metal and other cobalt products at the refinery of Pyrites Co., Wilmington, Del., was up 1.4%. The refinery of Metallurgical Resources, Inc., Newburgh, N. Y., did not produce any cobalt during the first 10 months of 1958.

Production of cobalt by International Nickel Co. of Canada, Ltd., Port Colborne, Ont., Union Miniere du Haut-Katanga, Belgian Congo, and Rhokana Corp., Nkana, Northern Rhodesia, was smaller than in 1957, but outputs by Sherritt Gordon Mines, Ltd., Fort Saskatchewan, Alberta, Falconbridge Nickel Mines, Ltd., Kristiansand, Norway, La Societe Miniere de Bou-Azzer et du Graaza, French Morocco, and Chibuluma Mines, Ltd., Ndola, Northern Rhodesia, were larger. The new hydrometallurgical plant and electrolytic refinery of Union Miniere, under construction near Kolwezi, Belgian Congo, were expected to be completed in 1960. A new and improved cobalt leaching circuit was installed in the refinery of Sherritt Gordon. The new nickel-cobalt concentrating plant at Moa Bay, Cuba, and refinery (capacity 4.4-million lb cobalt) at Port Nickel, La., of Freeport Nickel Co. (formerly Cuban American Nickel Co.) were expected to be producing by mid-1959. Concentrate will be shipped by special carrier.

The quoted price of metal and oxide remained unchanged at $2 and $1.52 a lb, respectively, throughout 1958•

Nickel

Hubert W. Davis
U.S. Bureau of Mines

DESPITE CUTBACKS in production by most producers and a strike of workers at the Sudbury mines and Port Colborne refinery of International Nickel Co. of Canada, Ltd., output of nickel was substantially greater than demand. Consequently, available stocks in North America in the hands of Inco and the U. S. Government on June 30, 1958, had reached a total of 135-million lb, exclusive of nickel in the National stockpile and held by consumers. However, stocks of U. S. consumers had declined from 46.6-million lb at the beginning of 1958 to 24-million lb on Sept. 30. OCDM authorized the diversion to industry of all nickel scheduled for shipment to the Government in 1959. This diversion will make available to the civilian economy about 100-million lb of nickel in excess of commercial supplies.

Production. Free World production of nickel is estimated at 195,000

"Government buying is the key to U. S. mercury in 1959" p 96 . . . *"Tin producing countries cannot continue export quotas without tightening the market. If Russia cooperates, price may rise."* p 96

John R. O'Connell, Jr.
Assistant Editor, Markets, E&MJ

short tons in 1958, a drop of 25% from 1957. Canadian output during the first nine months was 131,190 tons (down 8%), and exports were 137,824 tons (up 3%). Output of nickel oxide powder and oxide sinter in Cuba was 17,600 tons (nickel content) in the first 10 months of 1958 (down 3%).

U.S. imports of nickel in the first nine months were 94,700 short tons, down 14%. Imports from Norway and Cuba were up 25 and 1%, respectively, but those from Canada were down 20%. No imports were received from Japan and West Germany during the first nine months, compared with 555,700 and 351,600 lb, respectively, in the corresponding period of 1957. Imports from the U.K. declined from 168,000 lb to 23,000 lb.

U.S. consumption of nickel during the first nine months was about 55,000 short tons, or 42% less than in the corresponding period of 1957.

Output by International Nickel Co. of Canada, Ltd., was reduced 10% twice (in March and May) and in mid-July it was further curtailed to an annual rate of 200-million lb, about two-thirds of capacity. Because of the curtailment in output, work schedules at the company's Sudbury mines and Port Colborne refinery were reduced to a 4-day week basis from a 5-day week. On Sept. 24 output ceased because of a strike of employees. The curtailment of production did not affect the new nickel project at Thompson in Manitoba, which is scheduled for completion in 1960 and which will have an annual capacity of 75-million lb, making it the world's second largest nickel-mining operation.

Production at mines, smelter, and refinery of Falconbridge Nickel Mines, Ltd., was at a slightly higher rate than in 1958. The Fecunis mine commenced regular production of ore. Development work in preparing the Opaning and Boundary mines for production continued. The Norduna mine came into production in 1958.

Sherritt Gordon Mines, Ltd., operated its refinery at a slightly higher rate in 1958. In addition to concentrate from its Lynn Lake mine in Manitoba, it refined concentrates produced by Nickel Rim Mines, Ltd., North Rankin Nickel Mines, Ltd., and Western Nickel, Ltd. Operation at the Nickel Rim mine in the Sudbury area of Ontario was discontinued May 31. Production at the mine of Western Nickel, Ltd., Choate, B.C., which made its first shipment in February 1958, was suspended at the end of July. Sherritt Gordon entered into an agreement with Societe Anonyme le Nickel for it to use under royalty the Sherritt Gordon refining process at its new Le Havre refinery.

Output by Nickel Processing Corp. at the U. S. Government-owned plant in Cuba was at about 93% of capacity during the first half of 1958, when it was reduced about 25%.

Construction of a concentrating plant at Moa Bay, Cuba, and a refinery at Port Nickel, La., by Freeport Nickel Co. proceeded on schedule; production was expected to begin in mid-1959. The refinery capacity for nickel will be 50-million lb annually.

Hanna Nickel Smelting Co., Riddle, Ore., produced 38.6-million pounds of ferronickel containing 17.1-million lb of nickel in the first 10 months of 1958, compared with the 33.3-million ferronickel containing 14.7-million lb nickel in the corresponding period of 1957.

Output of nickel metal by National Lead Co., Fredericktown, Mo., during the first 10 months of 1958 was 38% more than in the corresponding 1957 period. National Lead Co. discontinued reducing Cuban nickel oxide sinter to metal at its Crum Lynn, Pa., refinery at the end of October.

Effective July 14 the price of Inco oxide sinter was reduced to 69.6c a lb (nickel content) f.o.b. point of entry from 70¼c a lb f.o.b. Copper Cliff, Ont•

Molybdenum

Wilmer McInnis
U.S. Bureau of Mines

RESEARCH on the use of molybdenum in applications where high operating temperatures are encountered began to pay dividends in 1958 when aircraft and missile producers placed sizeable orders for the strong metal. A new plant for producing upward of 800,000 lb a year of the arc-cast metal was completed, and several powder producers increased facilities for reducing molybdenum compounds to metal.

U.S. production, hampered by an 84-day strike at the Climax mine in Colorado and by a cutback in operations at most by-product plants, was the lowest since 1951. Output of 29.6-million lb in the first three quarters was 34% less than the quantity produced in the same months of 1957. Production from the Climax mine was off 41% and the quantity recovered as a by-product of copper decreased 23%, but the quantity recovered as a tungsten by-product was up 44% compared with the same months of 1957.

Inspiration Consolidated Copper Corp. became the ninth domestic producer when its molybdenite recovery unit was put in operation in April. Duval Sulphur & Potash Co. was constructing a molybdenite recovery unit at its copper operation in Pima County, Ariz., which is expected to be ready for operations early in 1959. Pima Mining Co. conducted research on the recovery of molybdenite from the copper ores of the Pima mine in Arizona, and Victory Mines Corp. was reported to have purchased and resumed development of the Kromona molybdenum mine and mill in Snohomish County, Wash.

Free World production during 1958 is estimated at 47-million lb compared with 66-million lb produced in 1957. Production in foreign Free World countries was largely from by-product operations in Chile and from small molybdenum mines in Canada, Norway, Japan and Mexico. Chile, which for years has been by far the

largest Free-World producer outside the U.S. gained new importance when operation of the molybdenite recovery unit at the large Chuquicamata copper plant got underway in July. Molybdenite concentrate recovered as by-product from the copper ores of El Teniente mine during the first half of 1958 contained approximately 1-million lb of molybdenum compared with 1.3-million lb during the same months of 1957. The combined output in Canada, Mexico, Japan and Norway was less than the quantity produced in Chile.

Data on production and consumption of molybdenum in the USSR and Soviet Bloc countries are not made available. However, it is reported that the large Kounrad and Agarak porphyry copper deposits are important Russian sources. Soviet production from these and other deposits might have been on the order of 9 to 10-million lb in 1958. In addition, Communist China and North Korea together might have produced 1-million lb or more that was made available for Soviet consumption.

U.S. shipments of molybdenite concentrate during the first nine months of 1958 totaled 29.6-million lb of contained molybdenum. Of this quantity, 21.6-million lb was shipped to domestic firms and 8-million lb for export.

Domestic consumption of molybdenum contained in concentrate in the first three quarters of 1958 totaled 22.4-million lb, a 17% decrease from the quantity consumed in the same months of 1957. Nearly all of the concentrate consumed was converted to molybdic oxide containing about 20-million lb of molybdenum of which 897,000 lb was export. The remainder was used in making other molybdenum products such as ferromolybdenum and molybdenum metal powder and for direct addition to steel and other alloy melts. Production and consumption of molybdenum metal powder increased 170 and 90%, respectively, compared with the same months of 1957. The increase was due primarily to much wider use of the metal in the manufacture of parts for aircraft and missiles. Owing to the low industrial level, consumption of molybdenum for most other uses was off sharply compared with the same months in 1957. The quantity used in making high-speed and other steels decreased 26% and that used in gray and malleable castings was off 28%.

Exports of molybdenum contained in concentrate and molybdic oxide totaled 9.3-million lb during the first nine months of 1958. This was the lowest annual rate since 1953.

"Titanium is in a healthier condition than it has been for some time. The adjustments have been painful, but the outlook is for improved growth at a steadily increasing rate." p 116

D. P. Eigo
Managing Editor, E&MJ

Prices of molybdenite concentrate and molybdenum products were increased by about 5% effective Nov. 1. The new prices are: Molybdenite concentrate $1.25 lb contained Mo, f.o.b. Climax, Colo., plus cost of container; molybdic oxide, bagged $1.46, canned $1.47, lb contained Mo, f.o.b. shipping point; ferromolybdenum, powdered $1.82, other sizes packed $1.76 lb of contained Mo in lots of 5,000 lb or more, f.o.b. shipping point; and calcium molybdate $1.50 lb contained Mo.

Outlook. Production and consumption of molybdenum are expected to increase in 1959. Demand for powder might cause production of that product to double the 1958 output•

Chrome

Norbert Blechner
Associated Metals & Minerals Corp.

THE BULK of chrome is used in stainless steel and alloy steels and, as the recent U.S. recession took its course, stainless and alloy steels were among the materials hardest hit. Yet, as business recovers, recovery in the chrome industry will be slow, as long as emphasis on low inventory continues.

The U.S. barter program, recently reactivated, will absorb quantities of chrome mainly in the form of ferrochrome, supplied mainly by foreign alloy producers. This will be a stimulant for shipments of chrome ore. Also, some direct barters of farm surplus commodities against chrome ore may be developed, as in the previous fiscal year. This again will be of help to the mines.

Prices for metallurgical chrome ore basis 48% Cr_2O_3 and ratio 3:1 were $37.00 to $40.00 c.i.f. U.S. port in 1947 and about $55.00 in 1956. Present prices for metallurgical chrome ore are nominal but as interest will develop, producers will find it difficult to obtain prices higher than $46.00 to $47.00 c.i.f. U.S. port for top grades. Prices will be substantially lower for inferior qualities. The price increase during this 10-year period is not commensurate with the increased cost of production, transportation and other cost items, but a result of supply and demand.

Any future shortage would be of short duration since producers in many parts of the world are able and eager to increase production with little delay. Furthermore, the U.S., at first by purchasing chrome ore, and later by bartering surplus commodities against chrome, has stockpiled a substantial quantity of chrome ore and chrome alloys as a protection against emergencies. By virtue of this barter program, chrome has grown on the farms of America.

Owners of chrome properties will be wise to prepare for quality grades and to develop ore reserves so that they will be in position to offer to consumers long term contracts of good material. This will be the best insurance for secure outlets at economical prices.

Total U.S. consumption of all grades of ore was 850,000 short tons in 1947 and about 1,850,000 tons in 1956. Consumption of metallurgical chrome ore increased from 386,000 tons in 1947 to 1,210,000 tons in 1956. The 1956 statistics include substantial shipments to U.S. Government stockpile. Yet the increase of consumption has been substantial. Consumption of metallurgical chrome ore increased during the last decade at

"Termination of two fluorspar programs eliminated the Government as a direct factor in the domestic market. Producers have been asked to wait for an investigation of acid grade." p 143

Robert B. McDougal
Commodity Specialist, U.S. Bureau of Mines

an annual average of about 8%. Increase of consumption in Europe has been even greater and amounted to an annual average of about 11%. Consumption of stainless steel, the principal use for the chromium alloys, would most likely have increased even more rapidly had the shortage of nickel not been a hampering factor for several years. During these years, aluminum replaced stainless steel in several industries and most of these markets have been permanently lost to stainless steel. However, with nickel restrictions now lifted, stainless steel consumption will grow, notwithstanding the continued competition from aluminum.

In any event, consumption of stainless steel is growing faster than of total steel and there is every reason to assume that consumption of chrome in the U.S. will continue to increase at an annual average rate of 8%. The growth figure of 11% in Europe and Japan includes non-recurring consumption during the reconstruction period; competent circles believe that the growth will continue at the same average rate for many years as the standard of living in those countries improves. Five to ten years from now, demand for high grade metallurgical lumpy chrome ore may outpace the available quantities, unless transportation improves from mines to ports. Transportation has been the bottleneck in the past and quite likely will be the hampering factor in the future, with the exception of Rhodesia.

Producers of ferroalloys have developed methods to use low priced chrome ore with low Cr_2O_3 content and low ratio in the production of charge chrome, which is high carbon ferrochrome with a low chromium content, and they will find it possible or necessary to increase the usage of these grades if consumption of such ferrochrome will increase or if there should develop a shortage of high quality chrome ore. Concentrate usage is also expected to increase.

Demand for refractory chrome ore will grow. The Philippines have been the principal source of supply of refractory chrome ore to U.S. There are no major fields of refractory chrome ore suitable to take the place of the Philippine's supply should the Philippine mines become depleted. If new sources of refractory chrome ore are developed, the question of price will be an important factor as, technically, it will be possible to reduce the chrome content and increase the magnesite content in refractories.

U.S. consumption of chrome ore in the chemical industry has grown at a slower rate. It was 152,000 short tons in 1947 and 160,000 short tons in 1956, almost all of which came from the Transvaal.

As underdeveloped nations aspire to promote their own industries, and where they have power and ore resources, they will try to supply domestic ferrochrome. This trend will be accelerated if a low world price makes export unattractive.

Should this occur, local industrialists will find it advisable to invite foreign know-how to participate in such ventures so that new productions can be adjusted to the continuously changing pattern of raw material requirements in the production of stainless steel. Legitimate protection of investors of capital and know-how will be a prerequisite for such participation.

European and Japanese producers have exported ferrochrome and chrome metal to U.S. and the share of foreign producers in the domestic chrome alloy market has increased steadily. However, foreign producers will realize that, notwithstanding the lower price of the foreign product, there will be limits to this market as domestic producers provide domestic consumers with many services, such as market research, convenience of supply on short notice, and reliability of supply during emergencies.

Outlook. When interest in shipment of chrome ore revives, the picture will not be quite the same as prior to the recession. Shipping facilities for ore from Rhodesia have greatly improved. During the same period, exports from Turkey have been hampered by high prices and other contingencies. The increase of Rhodesian capacity appeared to be of permanent nature as the railroad track system improved and large quantities of rolling stock arrived. The captive mines located in Rhodesia will be able to supply a substantially larger part than in previous years of the requirements of major domestic ferrochrome producers. The great efforts of USSR to develop trade with the U.S. again and supply chrome ore to U.S. cannot be ignored. The USSR is currently exploring several new chrome fields.

As the age of space travel dawns, the role which chrome will play can only be guessed. As the Atlas is orbiting the globe, it may well be kept in mind that its hull is made of stainless steel•

Tungsten

Robert W. Holliday
U.S. Bureau of Mines

LOW PRICES and a lessened industrial demand in 1958 contributed further to the decline in tungsten mining that followed suspension of Government purchase in December 1956.

Domestic production of concentrate reverted to the 1949-50 level and, in the last half year, virtually all output was from two operations, both depending primarily on the molybdenum content of their ores. Climax Molybdenum Co., produced by-product tungsten in Colorado and Union Carbide Nuclear Co., produced by-product (or co-product) tungsten in California. The only two other large producers in 1958, Tungsten Mining Corp. in North Carolina and Nevada-Massachussetts Co. in Nevada, suspended operations before the end of June.

Foreign Free World production of tungsten was also greatly curtailed in 1958. In Canada, production early in the year by Canadian Exploration Ltd., at Salmo, B.C. fulfilled a con-

tract with GSA. Continued production after termination of the contract was planned, but at a reduced rate. Mexico produced virtually no tungsten in 1958. Concentrate was shipped to GSA from Argentina during the first half but since termination of the contract in June, the State trading agency, only authorized purchaser in Argentina of tungsten ore, has stockpiled in hope of eventual price increases. Production in Bolivia decreased by 64% in the first quarter of 1958 compared to first quarter 1957. Many of the smaller tungsten mines in Brazil did not operate in 1958 because of low prices although one firm in fulfillment of a GSA contract continued a substantial production. In Peru production during the first half of 1958 was believed greater than for the corresponding period of 1957 but it was expected to drop sharply during the second half upon termination of a GSA contract.

The largest Australian producer, King Island Scheelite, Ltd., suspended operations in August 1958. Although reports have been somewhat conflicting it is believed that tungsten production at the Mawchi tin-tungsten mine in Burma has been suspended either because of insurgent activities or because of economic factors. Production data for the Republic of Korea are not available for 1958 but it was reported that about half the employees of Korean Tungsten Mining Co. were dismissed in September. According to one estimate, 1958 employment in the tungsten industry of Portugal was about 15% of the 1956 employment. Production in Spain was also far below that of recent years.

U.S. imports of concentrate decreased to 5.2-million lb, contained tungsten in the first nine months of 1958 compared with 11.5-million lb in the first nine months of 1957. Brazil (2,161,000 lb), Peru (841,000 lb), Australia (732,000 lb). Argentina (586,000 lb), Canada (363,000 lb), Bolivia (252,000 lb) and Korea (104,000 lb) supplied 97% of total imports in the first nine months of 1958.

E&MJ quotations for imported concentrate c.i.f., U.S. ports, duty extra declined from $11-$13 per short ton unit WO_3, in January to $7.50-$8.50 in September; by Dec. 11 the price had returned to $12-$12.50.

Consumption of concentrate declined sharply in 1958; in the first half it was 2.6-million lb, tungsten content, as compared with 5.2-million lb in the corresponding period of 1957. Despite an increased consumption in later months, the year's total was lower than for any year since 1954. Preliminary data indicate that about 39% of tungsten consumption was in steel and other alloys, about 39% in carbides, and about 15% in wire, rod, and sheet.

Research, as in previous recent years, was directed largely toward development of high temperature alloys. Because its melting point is higher than any other metal and because relatively large supplies are available, tungsten continued as a promising material for uses above 2000 deg F. Limiting factors include high density, room temperature brittleness, oxidation at high temperatures, and difficulty in fabrication. Research included work on production of extremely pure metal, analytical methods for determining trace impurities, melting and casting techniques, development of alloys, and development of basic data concerning the metal.

Outlook for tungsten is that the available supply, at least for the next few years, will be more than ample for normal industrial needs; imports will provide the major portion of concentrate consumed until prices and demand increase considerably. Consumption will follow the general level of industrial activity and should increase from the very low level of 1958•

Vanadium

G. E. Drake
Union Carbide Metals Co.

DOMESTIC SALES of vanadium in 1958 were about 2.5-million lb of contained metal in all forms of vanadium alloys, down by about 30% from the 3.6-million lb sold during 1957. This decline was somewhat greater than that of steel production as a whole, due to the steep decline in tool steel production, especially high-speed tool steels, during the period. Tool steel making offers ferrovanadium its prime market, wherein it has been used mainly for its effect of refining the grain of steels without impairing their hardness or ductility. It produces stronger and tougher tools with a built-in ability to take a keen cutting edge and hold it.

Vanadium is also called upon to improve the fatigue resistance of spring steels and strength of structural steels, to help condition nonaging rimming steels, to improve special wear-resistant cast irons, and help in the making of permanent-magnet steels. In 1958, ferrovanadium accounted for a little over 80% of the vanadium consumed in the U.S.—up 5% over 1957's 75%.

Because vanadium compounds such as vanadium oxide and ammonium metavanadate give beautiful colors in solution, they are used in the production of colored glazes for porcelain enamel and for ceramic wares. Other chemical uses of these vanadium compounds include: catalysts in the production of sulphuric acid, phthalic anhydrides, and maleic anhydrides, and drier and color fixitives in paints, dyes and inks.

The general decline in business was also felt by the compounds. Vanadium contained in ammonium metavanadate was down 23% to about 155,000 lb from 1957's figures, and vanadium oxide was down 50% to about 132,000 lb.

One area of vanadium production showed a truly spectacular increase: the production and sale of high-purity (ductile) vanadium. To meet the increasing demand which began early in 1958, Union Carbide Metals, tripled its facilities for pure metal production. Development of nuclear energy uses, a new supermagnetic alloy, and a new titanium-vanadium alloy all contributed to the rise.

Considerable vanadium is won as a by-product in the processing of uranium ores on the Colorado Plateau by Union Carbide, Vanadium Corp. of America and Climax Molybdenum Co.

There seems to be little doubt that vanadium has an important future as a constituent of titanium-base alloys. During 1958, at least three new vanadium - bearing titanium - base alloys were introduced.

Outlook. From the early indications of a rising trend which began in the late months of 1958, there are reasonable expectations that sales in 1959 will be better. If the upward trend continues, 30% more contained vanadium should be consumed in 1959 than in 1958. This level of consumption is estimated at about 3.4-million lb, approximately 95% of the 1957 use. Several new vanadium containing alloys can be expected in 1959, with many interesting high-strength and high-temperature characteristics•

"Lower rare earth prices will prevail, due to adequate reserves. Improved product and prices will aid in disproving the fallacy of 'scarcity'." p 106

Howard E. Kremers
Vice President—Market Development
Lindsay Chemicals Div., American Potash & Chemical Corp.

Manganese

Lemuel V. Reese
New York, N.Y.

EXCESSIVE INVENTORIES of manganese ore accumulated in 1957 were carried over into 1958 and increased by 38% to an all time high of about 2-million tons which may be enough for 1959. During 1958 the market was extremely inactive. Some say it began and ended on a sour note for almost all interested parties.

Barters and rumors of barters dominated discussion of new business possibilities. An exchange of a large tonnage of wheat with India for an equal value of manganese ore and ferromanganese was in constant negotiation. According to CCC and Indian officials, there is now a meeting of minds and final agreement is being arranged for an early date.

Estimates vary from $33- to 38-million as to what barter's gross value will be. It will include about 150,000 tons of 42% and as much as 25,000 tons of 46/48% manganese ore. The equivalent dollar balance will be delivered in standard ferromanganese from India.

Other barters had to be abandoned because homes could not be found for the manganese ore or ferromanganese, but 1959 brought more hope for barter on all sides. In fact, several other barters were in progress. Most of them offered steel products instead of grain for ore, with provision for conversion into ferromanganese.

A resourceful dealer in ores has arranged a barter in which a rather large U.S. steel firm is selling stainless steel and buying ferromanganese. The steel is being exchanged by the dealer for about 30,000 tons of manganese ore to be delivered from India to a big U.S. ferromanganese producer who supplies it to the steel company.

Nearly all steel companies have been approached by ore dealers who now have time to handle such transactions. They offer to barter on a multilateral as well as unilateral basis, and in 1958 several steel companies seriously considered this method for marketing certain products in other countries. Most of them faltered when they found it would be necessary to increase their inventories of ore and/or ferromanganese.

U. S. Manganese Ore

(Thousands of tons)

	1958[a]	1957	1956
Production	316	330	345
Consumption	1475	2264	2420
Imports	2009	2875	2231
Exports	5	4	6
Stocks	2002	1450	1284

[a] Includes estimates for the last quarter of 1958. Such facts and figures as are available indicate that in 1958 other countries experienced similar decreases or reductions in their manganese business.

Barter legislation was in the news during 1958. Pro-barter advocates struggled with anti-barter forces to obtain more favorable legislation and regulations than had been available since May 1957. After much discouragement and some defeat Public Law No. 480 was amended and extended to provide workable regulations.

Both sides claimed victory in the new rules which favor bilateral deals on a world wide basis. The changes have resulted in a small volume of new barter business which has not included manganese because trades in that ore are being held in abeyance until the big barter with India of wheat for ore and ferromanganese is done. In the meantime, it is noted that the new regulations do not seem to encourage as much barter business as is permissible under the law as amended to date.

An entirely different transaction was consummated early in January 1959. About 297,000 tons of very low grade manganese ore from Mexico stockpiled by the Government at El Paso, Tex. has been sold "as is" and "where is" to a private company for 17c per long unit of contained manganese. That price is basis 30% Mn with about ½c bonus and penalty.

The amount is large, but in comparison with other grades the ore in this deal is about equal to 175,000 tons of medium grade. Since the buyer has two years to move his ore, the deal does not set a market trend, although potential sales are reduced by the very substantial tonnage.

There is nothing in the stockpile regulations to prevent resale but the buyer is expected to process all of the ore himself. Its sale may save the taxpayer some money but even though there are firm restrictions on the sale of most Government owned minerals, this constitutes an exception which is of some concern to private consumers, and perhaps to the ore trade as a whole.

Another report is that Amapa (ICOMI-Bethlehem) is exercising its option to deliver about 200,000 tons of manganese ore to the U.S. Government stockpile during 1959 at the original lean contract support price which is about 76c, including quality bonus, per ltu c.i.f. eastern seaboard states.

Ore is high grade and is in addition to the tonnages which Brazilian affiliates and Bethlehem Steel Co. may take. Aside from its effect, if any, on the market price, this action takes a substantial amount of ore off the market or 1959.

Inventories in small as well as big plants are considered too large. Most of them are under the control of a committee instructed by the Boards of Directors to liquidate a large percentage of stock before ore purchases are made.

Experienced buyers predict that unless consumer stocks dwindle rapidly under unforeseen conversion, the major portion of new purchases must be for diluting the impurities in the ores which the plants now have.

The industry does not see how such purchases can be in large volume. Some buying for use in special processes and purposes is being done and is expected to continue but most ore buyers are not authorized to even discuss normal purchases.

Among other causes for pessimism is the possibility of a strike in the steel industry which would involve almost all makers of ferromanganese.

The 1956 union agreement expires June 30. Opinions differ but if steel and/or ferro production is seriously interrupted, a lot more ore will be left in consumer stockpiles.

So much evidence points toward prolonged bargaining over labor matters that Ore Control Committees are said to have decided to assume that they must lower their estimated withdrawals during the third and fourth quarters of 1959. Only a few are more optimistic.

The domestic manganese ore purchase program which began in 1951 under the Defense Procurement Administration ended in 1958 with completion of deliveries totalling 6-million long ton units of manganese. It was revived and is continuing under a "small producers' program" which includes mineral exploration but does not contemplate expansion.

Even though the market in 1958 was inactive and there is doubt about 1959, considerable progress in other directions was made along technical lines, including the creation of new facilities for processing manganese ore.

In January 1958 another non-captive blast furnace with a daily capacity of 400 to 600 tons was put into operation in Pittsburgh. It can produce other alloys as well as ferromanganese.

Amapa Mines in Brazil approached peak capacity and demonstrated that at least 500,000 more tons of high grade manganese ore than is required by its owners can be made available.

A new ferromanganese plant for South America was put into operation early in 1958. It is assured of an adequate ore supply by affiliation with one of the well established mining companies. A part of the ferro production is available for export.

India's first ferromanganese plant began operation in the Joda Valley of Orissa about the middle of 1958. Several plants in other areas came into production during 1958 and some of their products were exported to the U.S. and other countries. Conversion of India's ores into ferromanganese marked the beginning of a new era in the metal and ore business of that country, and another effort to compete with manganese mines being developed and expanded in Brazil, Mexico and several African States which would challenge India for second place to the USSR in production. Next in line to Brazil is South Africa, but Ghana, Belgian Congo and French Morocco help divide the available business.

The seriousness of the Indian manganese ore position is indicated by reliable reports that at least a score of mines have been closed and thousands of workers are unemployed. Mine owners claim that increased costs of doing business make such actions unavoidable.

In all of this the State Trading Corp. of India during 1958 maintained its control of the Indian ore trade but does not seem to have attained the success it desires. Buyers in almost all countries have been personally approached by STC executives. Except for sales of the barter type akin to the iron ore deal with Japan, the STC men have not created a satisfactory volume of new business.

On Nov. 24, 1958 India repealed the 30 rupee export duty on 44% and all higher grades of manganese ore. It was the last of the duties reimposed in 1956 which covered all grades except 38% and less. Wide differences of opinion exist but Indian producers seem to agree that more business will be done without any duty.

A quota system of control on the exportation of manganese ore about which mine owners in India complain is still effective. Under that system the Indian Controller of Imports and Exports grants licenses in accordance with each shipper's export record, which they say is not always adequate.

About Jan. 8, 1959 it was reported that a reduction in rail freight rates of India on Mn ore can be expected on an early date. The report assumed that rates will be reduced to what they were before October 1958, when the objectionably high rates became effective.

U.S. Imports varied more than is indicated in the summary. Actual figures are not available for the last quarter, but the high of 326,064 tons in January dropped to 145,150 tons in August 1958. It is interesting to note that stocks were almost in balance with imports as the year came to a close.

Ore prices per long ton unit of manganese, basis 46% and 48% c.i.f. U.S. ports, import duty extra, Indian export duty included, were $1.36 and $1.39 in early January 1958. From late January through April they were $1.33 to $1.36; in May they dropped from $1.30 to $1.17. June and July eased to $1.10 and $1.15. From late July through late November, they fell to $1.05 and $1.10 which held until the repeal of export duty left the price range $.915 to $.965 which still is effective.

At this writing it is reported that due to mine closures the supply of Indian manganese ore is not as good as it was a year ago, that prices (excluding duty changes) have been stable for at least four months and that consumption, although slightly better than last summer, is still less than in early 1958.

It is difficult to be more encouraging about the market for 1959, even though others are of the more optimistic opinion that in 1959 the next most important mineral to iron ore in the steel industry will enjoy greater demand than is now in evidence. They feel there are factors in the general economy which even now are stimulating steel and related industries •

Rare Earths *(Continued)*

bastnaesite and for misch metal continued at approximately 1957 levels, in the area of $1 and $3 per lb respectively. Prices for rare earth chemicals produced from monazite held rather constant, but there were some declines in some materials.

Reductions in prices for separated purified rare earths again dropped due to improved separation techniques, larger sales, and to competition. Although there were not so many dramatic reductions in 1958, declines brought nearly all of the rare earth oxides to prices below $1 per gram for small lot orders. Production and sales of the heavier rare earth metals in quite pure form showed significant improvement.

Research on applications and production methods continued in industrial and Government laboratories. Use applications continued to be investigated for the most part by the final user. The application research program sponsored jointly by seven rare earth processors and users at Battelle Memorial Institute, Columbus, Ohio.

Nuclear reactor poisons utilizing samarium, gadolinium, europieum, and dysprosium materials continued to receive attention.

Outlook. Raw materials appear to be adequate to sustain the present scale of the industry for many years. Both domestic and foreign ore sources will continue to supply requirements, but lower prices for ores will prevail, due largely to adequate industrial reserves.

Productive capability still exceeds demands. Competition, both domestic and foreign, will result in improved products and prices for users. Industry advertising will continue to point out the fallacy of the scarcity of the rare earths•

Metal and Mineral Processing

James W. Franklin
Associate Editor

THREE EVENTS were outstanding in mineral processing during 1958. The first was Kennecott Copper Corp.'s announcement and patent on bacteria leaching of low-grade ores. The second was Carpco Research & Engineering's development of a dry electrostatic process for iron ore. The third was International Nickel Co.'s commercial process that yields refined nickel electrolytically from nickel matte rather than metal.

In addition to the Carpco, Kennecott and Inco developments, there were others of note that will exert considerable influence on metal and mineral processing techniques in the coming years—Dings Magnetic Separator Co. will market the Quaker Oats electrostatic separator, the Coronatron; Hydrometals Inc., the old Illinois Zinc Co., has a process for electrically-ignited bomb production of refractory metals; Texaco Development Corp. is investigating an instant-grind, instant-leach technique which uses ammonia, carbon dioxide, heat and high pressure.

Dow has announced a resin ion exchanger that can be recovered from the pulp with a magnetic separator. Two men from Bicroft developed an electronic waste rock picker that cuts out 200 tpd from Bicroft's grinding circuit, and four companies announced new steps forward in direct reduction of iron ore.

These four were—Koppers Co. and Strategic Materials Inc. with the Udy Process; M. W. Kellogg with the HyL Process going in at Monterrey, Mexico; Krupp, which plans a plant in Greece and may build another in Mexico at Durango; and R-N Corp's. process may be used in the U.S.

Several innovations in uranium milling are noted below.

Bacteria Leaching Beats Low-Grade Ore

Kennecott Copper Corp. has obtained a U.S. patent on bacteria leaching of ores containing sulphides and/or iron sulphate. According to Stuart Zimmerley, director of research and one of the inventors, Kennecott found that several strains of iron-oxidizing autotrophic bacteria occur naturally in mine waters at Bingham Canyon and Chino.

These bacteria are able to live and multiply in relatively high concentrations of dissolved copper, and can be used to leach and recover copper, molybdenum and zinc from their sulphide or mixed oxide-sulphide ores. In addition, processes have been developed which use bacteria to upgrade iron-chromite and iron-titanium materials by leaching out the iron.

Kennecott's processes involve the use and continual regeneration of a ferric sulphate sulphuric acid lixiviant which has been inoculated with iron-oxidizing autotrophic bacteria tolerant to relatively high concentrations of the particular metal or metals being sought.

For many years, waste water flowing from certain copper mines has been deliberately percolated and re-percolated through waste ore dumps and even back through the worked out areas of the mine to leach out whatever copper values might be contained. Copper has been recovered by scrap iron precipitation. In some cases very low grade ore deposits have been leached in-place in this manner, but, generally speaking, the procedure has been regarded as far too slow to be economic if any other method is applicable at the same time.

Ferric sulphate and sulphuric acid naturally present in the mine water is responsible for the solution of the copper. Ferric sulphate is also an effective lixiviant for a number of other metals. For example, metallic copper and iron are readily attacked by a ferric sulphate solution. Recovery of metal values from certain secondary or scrap materials, and upgrading of metallurgical products after a reducing roast are possible through ferric sulphate leaching.

Iron-bearing chromite and titanium materials can be roast-reduced and the metallic iron removed by ferric sulphate leaching. While lead sulphate is not readily soluble in brine solution alone, it is if ferric sulphate is present in the brine. Ferric ion in solution has proven to be valuable in the purification of electrolytic zinc and manganese solutions—the ferric ion serving as a carrier, removing the impurities from the solution.

In all these uses, the ferric ion is changed to ferrous by reason of the metallurgical reactions taking place during the leaching procedure.

Principal deterrent to any widespread use of ferric sulphate-sulphuric acid leaching, has been the need to regenerate the spent lixiviant before recycling it to fresh feed. In acid solutions, regeneration poses a considerable problem. Atmospheric oxidation of acid ferrous solutions to the ferric state is slow and not aided materially by aeration. While regeneration has been accomplished by the use of SO_2 and aeration, use of ferric sulphate-sulphuric acid leaching has been greatly hampered and limited by the need to generate the SO_2.

In recent years, research work carried out on acid mine waters from coal mines in eastern U.S. has proven the existence of iron-oxidizing autotrophic bacteria which oxidize ferrous ions to ferric much faster than can be done by atmospheric aeration. This strain of bacteria has been tentatively named *Thiobacillus ferroxidans.*

More recently, research by Kennecott Copper on acid mine waters at Bingham Canyon and Chino has proven the existence of similar strains of iron-oxidizing autotrophic bacteria. And a definite indication of the ability of these bacteria to put many metal sulphides into solution, in addition to making the ferrous-ferric conversion, was discovered.

And in cases where the acid is all used up by the leaching process without a corresponding decrease in iron content, the ferric sulphate produced above may hydrolyze, precipitating the ferric salt and liberating more acid.

Such hydrolysis can be valuable if there is enough iron present. Where insufficient iron is available, sulphuric acid may have to be added to protect the ion make-up of the solution.

Iron may be added in the form of pyrite. Iron may be bled off the solution circuit where necessary. Kennecott warns that the equipment must be made of raw materials which will not kill the bacteria, such as red wood launders, tanks, etc.

Temperature must be controlled so as not to kill or immobilize the bacteria. Kennecott suggests a practical operating temperature maximum of 40 deg C.

Optimum pH in the Kennecott research appears to be 2, but excellent results have been obtained with pH range of 1.5 to 2.5. Bacterial activity decreases progressively and signifi-

cantly below pH 1.5, the report states.

Laboratory work has shown the possibility of enhancing bacterial action by adding certain nutrients to the lixiviant. Nitrogen in the form of nitrate or ammonium ion increases initial rate of activity, but apparently does not affect the later stages of the reaction. Bacterial activity increased significantly with increased nitrogen additions from 0 to 200 ppm, but economic optimum appears to be 100 ppm. However, after six months of operation, unfed and nitrogen fed bacteria showed the same degree of activation on new sulphide ore.—Source U.S. Patent No. 2,829,964, dated April 8, 1958. Inventors Stuart R. Zimmerley, Dean G. Wilson and John D. Prater, assigned to Kennecott.

Along these lines, the Portuguese uranium producer at Urgerica is taking advantage of natural leaching. The firm stockpiles low-grade ore, blended with a little pyrite and ferrous sulphate and waits for rain. Liquor flowing from the dump during rainstorms is collected and 60 to 80% of the uranium in the ore is recovered.

High Tension Electrostatics Win Iron Ore

A technique has been developed by Carpco Research & Engineering that is being piloted—a method to produce a 65% Fe concentrate with better than 90% iron recovery. In some cases a 68% Fe on 95% recovery has been obtained in test conditions.

Using Quebec specular hematite crushed to minus 20 mesh and dry classified to 200 mesh, two concentrates (a plus and a minus-200 mesh) were produced with a total 97.5% iron recovery.

Ore was 38% Fe and the feed rate one-half long ton per hour per foot of rotor length. Preliminary results showed that less than five feet of rotor length are needed to handle one long ton per hour feed. Further testing followed and produced these results.

Magnetite, martite and hematite minerals react in an identical manner under high-tension statics. When they occur together, all three can be recovered by one simple, inexpensive process. In present-day taconite projects, only the magnetic fraction is recovered. Furthermore, the most common gangue element in the ores tested so far is silica—a good insulator or dielectric, which makes it easier to complete the separation of mineral and gangue.

The High-Tension Process as applied to iron is not nearly as high in cost as one would tend to believe.

Carpco says to treat one long ton per hour of iron ore in a minimum plant of 5,000 tpd feed, using 5 ft of rotor length per ton of feed—

Maintenance (labor and materials)	0.274c
Rotor ft/hr	1.534c
Power cost at 1c/kwh	0.234c
Labor at $5,000/man-year	2.286c
Total	4.054c

With higher recoveries and higher grades than possible from most wet processes, the process offers one additional important advantage over current techniques: it does not require water, since the material must be surface dry to get a good separation. In the great iron fields of northern Canada water is frozen solid most of the year—a serious handicap to any iron mining venture in this area. With a dry process, the water problem is solved.

Capital costs of a High-Tension Process may be higher than that of a wet process of same capacity, but Carpco and Joy Mfg. Co. say that the very low operating costs, as shown above, make the process worthy of consideration. Joy Mfg. Co., Pittsburgh, Pa. has taken over and will manufacture, sell and service production size machines.

Jones & Laughlin Steel Corp., in partnership with Cleveland-Cliffs Iron Co., has exercised its option to obtain a 99-year lease on the Mt. Wright iron property of Quebec Cobalt & Exploration Ltd.

Approximately 1-billion tons of crude ore, containing 335-million tons of iron concentrates have been proven by drilling and indicated by mapping, J&L said. Both gravity and electrostatic separation methods have been tested to extract the specularite and hematite ores. "Tests to date," J&L says, "have yielded . . . grade of iron concentrate up to 70%, with recoveries as high as 97.5%."

Property is located about 180 miles north of Seven Islands and five miles north of Cartier Mining's Mt. Wright deposits.

Recent Advances in Smelting and Refining

International Nickel Co. is producing 99.9% Nickel at Port Colborne, Ont., starting with nickel matte (low in copper) according to L.S. Renzoni, R.C. McQuire and M.V. Barker in their paper before the 1958 annual AIME meeting in New York. Inco is now able to bypass the smelting steps, and to recover pure elemental sulphur and a high-grade selenium sludge from the process.

Specially cast sulphide anodes are cooled under controlled conditions, then inserted into Dynel bags and put into the 1600 electrolytic cells in the tank house. Reaction proceeds:

$$Ni_3S \rightarrow 3Ni^{++} + 2S$$
$$+ 6e \rightarrow 3Ni + 2S$$

Nickel plates out on the cathode, while sulphur collects as an anode sludge in the Dynel bags from whence it is separated from unreacted nickel sulphides. Sulphides go back to the reverberatory, while the sulphur is refined by steam distillation to pure sulphur. By-product from sulphur purification is a selenium-rich sludge that is sent to the refinery for recovery. Cobalt and copper are recovered from the anolyte solution.

Voltage in the nickel cells is 1.2v—about 1v higher than generally needed for metallic nickel anodes. Efficiency is 95%. Electrolyte temperature is 145 deg F, and under strong acid conditions of the electrolyte (nickel chloride-sulphate catholyte), Inco had to install synthetic resin liners for the cells.

Hydrometals, Inc. has an electrically-fired bomb process that has shown that many refractory metals can be reduced successfully. So far columbium, tantalum, boron, tungsten, vanadium, zirconium, titanium, beryllium and other metals have been produced. Process is semi-continuous. Reagents are added, reacted and withdrawn from the bomb before the metal can react with the refractory lining. Operating temperature is about 5,000 deg F at 500 ton pressure per sq in.

A patent has been granted to Peter L. Paull, Norwalk, Conn. and assigned to Texaco Development Corp., N.Y., N.Y., for a process that uses heat, pressure, ammonia and carbon dioxide in a manner to instantaneously pulverize and leach oxide minerals from low grade ores. Patent No.

2,847,300 specifically mentions such oxidized minerals as malachite, smithsonite, calamine and hydrozincite.

Basically, the process is one of heating the ore slurry to high temperature under high pressure, then releasing the pressure to disintegrate the ore particles while at the same time adding ammonia and carbon dioxide to react with the minerals.

One example from the patent will suffice: A low grade zinc ore containing 4.21% smithsonite was crushed to 14 mesh, slurried with water and pumped at 505 psi through 400 ft of ½-in. iron pipe at 935 lb per hour feed rate to an opposed nozzle grinder having 5/32-in. orifice. Outlet pipe temperature was 900 deg F, and downstream pressure was 32 psi. Particles disintegrated to minus 325 mesh. Ammonia and carbon dioxide were injected at the pressure release point and all the zinc minerals went into solution. Solution was filtered, and the zinc precipitated as hydrous zinc carbonate assaying 57% zinc and giving a 93% zinc recovery.

Direct reduction of iron ore is moving closer to being commercial. The R-N Process will be used by a large U.S. steel firm. The firm is asking for bids from manufacturers for equipment to build a large facility, probably in the neighborhood of 500,000 tpy feed to be built at one particular location where ore, raw materials, end-use and transportation combine to make the process economic.

Koppers Co. stepped into the high-promoted Udy Process, and after months of research satisfied themselves that it works. Koppers will guarantee it for small plants in local areas where low-cost electric power, ore and raw materials are available. Strategic Materials Corp. is working on the method in connection with the production of ferroalloys. Early in the year, it was reported that Gunnar Uranium would test ore from their chrome deposit at the Strategic Materials pilot plant.

M. W. Kellogg announced that it would build a 500 tpd direct reduction plant at Monterrey, Mexico, for Hojalta y Lamina, S. A. A pilot plant has been producing 200 tpd sponge iron at Monterrey for some time. The HyL Process is a batch-gaseous reduction method similar to the Madaras Process. Sponge iron may also be produced at Durango, Mexico. The Mexican government is studying the Krupp-Renn Process. Brazil has a group looking into the possibilities of either a Weiberg or Hoganas installation. Krupp is developing an iron deposit on off-shore Greek islands and may install a plant there. Krupp-Renn pellets were tested at Gusstahlwerk Witten and it was found that such pellets can be used at up to 40% of the charge with considerable cost savings (A. Richter, et al, *Journal of Metals*, September 1958).

High purity metals are being refined by electron beam melting and casting under high vacuum in the order of 0.01 to 0.1 μ at Stauffer-Temescal Co.'s Richmond, Calif. plant. So far titanium, zirconium, tungsten, tantalum, molybdenum, beryllium and columbium have been refined successfully.

The gun, powered by a high voltage dc power source, serves as the cathode, while the melting stock is the anode. As the material melts it flows into a holding crucible from which ingots are pulled through the bottom. Gases and impurities which form compounds having at least 10^{-5} vapor pressure boil out, due to the vacuum (Stauffer release).

Uranium Millers Stress Cost Cutting

At three mills, control of pH has become very important. Mary Kathleen, soon to be onstream, will try to keep the pH under 1.9 at 40 deg C leach temperature to prevent complications due to phosphate and silica in the local ore. And Port Pirie has found that leaching at 60 to 65% solids, then dropping the hot pulp into four times the volume of cool mill solution and liming to pH 1.0, causes the titanium present in the davidite ore to hydrolyze so that it can be decanted. Eldorado at Beaverlodge has licked corrosion in pressure leach by keeping pH above 9.7. Leach is carbonate. Corrosion appears to be due to the presence of sulphides in the ore, according to William Lennemann at AMC.

In South Africa, some of the mines are leaching different ores separately, then combining the pregnant liquors, on the premise that this method is more economical, offers better control and better recoveries.

National Lead says that 0.5 gm/l Cu and 3 gm/l NH_3 in a leaching circuit react to produce a very cheap method of controlling oxidation and maintaining uranium in the hexavalent state. Also, National Lead's Eluex Process has been installed at Edgemont. Loaded ion exchanger resins are stripped of uranium with 8 to 10% H_2SO_4, then extracted with EHPA in kerosene. Raffinate from the solvent step goes back to leaching section. Solvent is stripped with sodium carbonate. Advantages are that the system prevents buildup of nitrate and chloride in the circuit and that tailing pond water can be reused in the plant. While Edgemont uses sodium carbonate, Lennemann notes a trend in the industry toward sodium nitrate as a stripping agent due to slightly lower cost, lower sulphate contamination of concentrate and simplified resin regeneration process needs.

Centrifugal contactors are used to load solvent and to strip the solvent at Texas-Zinc Minerals mill and also by the Florida operators of pebble phosphate uranium pilot plants. Texas-Zinc uses the Podbielniak unit, while the Sharples design is used in Florida.

Texas-Zinc Minerals Corp. is using two Podbielniak centrifugal contactors in the solvent extraction process with considerable success. One large unit treats pregnant liquor at up to 500 gpm to load the solvent with uranium. A second smaller unit strips uranium from the solvent. Advantages are low capital cost, simplified flowsheets and low operating cost. Also, the units cut solvent inventory from 60,000 gal for an equivalent size mill to 3,000, according to Neill K. Bank, general manager at AMC.

Two employees at Bicroft Uranium Mines Ltd., Bancroft, Ont., have developed and put to use an amazingly efficient waste rock eliminator known as the K&H Electronic Sorter, according to the *Northern Miner*.

Based on limited testing of plus 3-in. rock, the Sorter is expected to remove some 200 tpd of waste from the mill feed—a two-way saving—raising the pounds-uranium-processed capacity of the mill; and cutting grinding and reagent costs.

Some estimates place the value to Bicroft at $400 a day in milling costs; savings would be higher at mills having higher acid consumption per ton of mill feed. No decision has been made as yet as to the possibilities of marketing the device. The Sorter can be used to upgrade gold ore as well as uranium, and its possibilities as regards magnetic ores is being checked. J. Kelly, chief geologist and J. F. Hutter, chief engineer, developed the K & H Electronic Sorter. Bicroft says the device is still experimental•

Mining Practice: Part I

Lloyd E. Antonides
Associate Editor

NUCLEAR BLASTING and electromagnetic rock breaking, as "tools", and the industry's growing realization that every company must budget for systematic operational research, as a trend, were 1958 developments that have the greatest potential for affecting future mining practice.

Some outstanding practice and product developments of more immediate utility, which first became part of the public knowledge during 1958, are:

simpler electromagnetic prospecting using only a receiver to pickup natural, magnetic oscillations;

faster, more definitive aerial EM work using two airplanes and a rotary field;

quick-setting hole stabilizing agents that can be injected past the bit to permit coring or air-flush drilling in incoherent or wet ground;

a means of anchor-bolting a feed shell of a drifter when drilling small down-holes, which gives an intermediate alternative to hand-held sinkers and tripod-, column- or wagon-mounted drills;

a raise-driving platform elevator which runs on an extensible guide-rail that is anchor bolted to one wall;

a method of "cage-stoping", using horizontal holes from a rope-suspended platform as in cage-raising;

the underground use of low-cost ammonium nitrate-fuel oil explosive;

a powerful, low-cost ammonium-nitrate-TNT-water slurry explosive for wet holes on the surface;

a rockbolt grouting scheme designed to increase anchorage in poor ground by using a quick-setting resin in a frangible tube on the end of the expansion shell;

the use of lightweight, non-corroding aluminum rockbolts;

huge single-unit 70-ton and two-unit tandem 130-ton capacity earth-moving scrapers which are propelled by "electric wheels" with hub-mounted motors fed from a cab-located diesel generator;

the use of inexpensive, thin polyethylene tubing for ventilation ducts;

and compact, pulseless screw-type air compressors for stationary and mobile applications.

There were, of course, other new techniques and equipment announced, as well as wider adoption of a number of the developments mentioned in previous *E&MJ* annual reviews.

Nuclear blasting offers a means of reducing the explosive-emplacement work and the explosive cost in rock breaking to such a small amount that it can be called a revolutionary development. Its civilian use moved closer to reality in October when the U.S. AEC fired four underground shots as part of the Plowshare program (*E&MJ* Jan59). They ranged in yield from 80 tons to 23-kilotons TNT equivalent. Two formed surface craters.

The program started in September 1957 with the 1.7 kt "Rainier" test (*E&MJ* Apr&Oct58) which proved that such explosions could be completely contained and that, in silicate rocks (tuff) at least, the radioactivity is limited to a small amount of insoluble fused material that can be easily handled. The latest shots confirm the absence of any severe radioactivity problem. It is believed that all the shots were the fission type. Fusion devices, being "cleaner" among other things, offer even more promise.

The rock mechanics of nuclear blasting appear to be the same as with conventional explosives except that much more of the yield is lost in heat and light (about 35%) and radiation, (about 15%). Even so, the enormous energy in such a small package is a great advantage in rock breaking. In the case of Rainier, an energy charge equivalent to 3,400,000 lbs of TNT occupied less than the 6x6x7-ft volume of the shot point room.

Even if—because of its spherical energy distribution — this shot broke only 200,000 tons satisfactorily, it still did not require anything like the placement system for normal blasts. For example, 794 drill holes at least 6 in. x 30 ft were used for Reserve Mining's huge taconite pit blast (in August) of 313 tons of explosive which broke 1.14-million tons. And over 1½ miles of access and placement openings were used for the largest authoritatively-known non-atomic blast, a coyote-type of 1.4 kt which removed 155,000 cubic yd of the Ripple Rock shoals north of Vancouver, B.C., in April (*E&MJ* May58 p. 158).

If the nuclear blast energy can be distributed along openings, the powder factor should improve greatly without much increase in preparation. Plowshare officials believe the energy can be distributed so that rock broken per unit of energy will be increased to ten times that of a spherical or crater shot. And size of fragmentation appears excellent for contained shots.

Cost figures do not seem to be available on nuclear devices, but on a weight of TNT equivalent basis they appear to be very low. Some data in *Scientific American* (Dec58) permit making a "guesstimate" that gives the almost unbelievable figure of $1.00 per ton equivalent of TNT —about one-hundreth the cost of fertilizer grade ammonium nitrate!

The combined heating and rock-breaking effect is perhaps of even more immediate utility. Some uses are: leaching in place, liberating oil from Colorado shales and Alberta tar sands, melting salt and sulphur, and generating steam for power (*MCJ* Nov58)*. The last is planned for this summer and the second is being discussed. [*see index on p. 169]

Electromagnetic rock breaking holds promise in that it eliminates the age-old problem of abrasive wear on a mechanical contacting element. For most rock the problem is not particularly acute, and for certain weak-bonded types hydraulic mining is an answer. But with hard abrasive rock the high forces needed for breaking make wear a serious obstacle. For blasthole drilling in quartz-bearing and some other hard rocks, this problem was solved several years ago by development of an efficient jet piercer which uses heat-spalling to make an opening. But the electromagnetic scheme is a development that completely removes not only the drilling but the blasting problems as well, and it reduces comminution problems too.

Electromagnetic fracturing of taconite was a U.S. patent grant in November (*E&MJ* Jan59). It can be used for mining in place or in milling. Fracturing apparently results from tensile failure due to localized differential expansion produced by one or more of the thermal, piezoelectric and magnetostrictive effects of the alternating magnetic field on the magnetite-bearing quartzitic rock. According to the authors, energy of about 25 kw at 5 megacycles is transmitted from a coil at close range. For mining they suggest making a pass over the formation using a tractor-mounted coil and generator, and then scraping off the fractured material to expose a new layer.

Although the patent was applied for in September 1951 and has been assigned to Armco Steel Corp. (one of the Reserve Mining group), there has been no public announcement of

an operational unit. On the other hand, the Soviet All-Union Coal Research Institute has announced they have both a 20-lb "ray gun" and a larger mining unit in "serial production" which employ "short (10 cm) radio waves" to break hard rock such as granite and sandstone (*MJ* Oct 24, 1958).

The gun is described as having "3,000-megacycles per second, 2.5-kw radiation power." It is connected to the power source by a cable and is used both underground and on surface. It is especially useful for breaking boulders and can be adjusted to cause spalling or "deep explosion." "Fragmentation takes place when energy is converted into heat" about 20 sec after the unit is turned on.

In this announcement the Soviet agency says the "radio" scheme is "superior"—though not in what way—to thermal, chemical and all other non-mechanical methods for "breaking" such rock. Yet earlier last year a USSR release proudly announced the successful development of a "thermal drill" for blastholes in similar rocks. Its description was very similar to the U.S.'s 10-year old Linde Co. jet-piercer that has proven so successfull in taconite and some other hard rocks (*E&MJ* Jul58).

Systematic research on operations in exploration and in mining and its profitable payoff has been described widely in the literature and at meetings, especially during 1958. Examples now range over coal, iron, phosphate, copper, lead, uranium, zinc and gold operations and in many sections of the U.S., in Canada, and in South Africa.

Some of the companies' programs are only starting—usually with new-equipment testing, using statistical methods and methods studies involving work simplification and standardization, job and wage rating and similar aspects. Others are growing up through a more comprehensive stage of industrial engineering or scientific management—embracing: cost, quality and inventory control; group incentives, organization and communications; facility layout; personnel selection testing; etc. A few have reached a high level of sophistication using systems engineering or operations research to optimize performance by mathematical solution of complex problems through study of fundamental functions and the integration of many scientific and engineering disciplines.

Undoubtedly, this trend is founded on unrelenting economic pressures. The trend is helped by the success of such research in other industries. It is also prodded by the ever quickening pace of engineering and scientific developments with their shrinking time-lag in effect on methods and equipment. These situations rule out the casual approach of the past toward operational research in the future.

Unfortunately, there is not much evidence that the recession fanned what had been a healthy spark of mining support for basic or science research — meaning physics, chemistry, geology, geophysics, rock mechanics, mechanics of materials, machine and instrument design, psychology, et al.—which is the fountainhead of applied and operational research. This lack of interest in basic research by our industry was pointed out in last year's review. It was reported that there was a very cool reception to the efforts of several groups to establish some sort of title and/or abstract translation service covering the valuable foreign contributions to mining technology. The British IMM has such a service and the U.S.'s AGI offers a comprehensive one in the earth science field.

One consequence of the trend toward systematic operational research concerns education and employment of technical personnel. There is a close interest in education on the part of a number of mining officials. It stems, perhaps, from an awareness that new generations of mining engineers—especially if they are to develop into managers—must understand, take part in, and use such research. To do this they must have a broader grounding in basic science and engineering than is common now. At the same time it appears that there will be increased employment of specialists in disciplines which have not been particularly associated with mining in the past.

Exploration Developments

EXPLORATION PRACTICE since the war has probably been affected most by the use of aircraft. Fixed-wing types permit rapid surveys of large areas using photo-topographical, photo-geological and geophysical techniques. They also solve many transportation problems both in the reconnaisance and later stages. In the last few years, the helicopter has given aerial work another boost. It permits getting more detailed information on smaller areas and offers an answer to some of the severest transportation problems. In Canada, where both the government and groups of companies have undertaken to survey large areas, it has been estimated that for comparable results a ground survey would require five times as many hours as a fixed wing aerial survey. In Western Australia, the helicopter cut the time for geological work in a desert area to one season as compared to three seasons for comparable work without the aircraft, and for about the same costs.

Using statistical techniques to predict the possible value of a prospecting venture is a handy tool for planning (AMC Mtg, Slichter).

In planning exploration, Kennecott Copper begins with an indirect 1:2,-500,000 -5,000,000 map reconnaissance, then goes to the direct stage using aerial geological and geophysical techniques, ground geology, geochemistry and geophysics, as applicable, before drilling and making exploratory openings (AMC Mtg, Jerome).

"Saturation prospecting" is a new concept at Flin Flon in which surveys are made in ever widening circles using many "tools" and drilling all anomalies (CIMM Mtg, Riley).

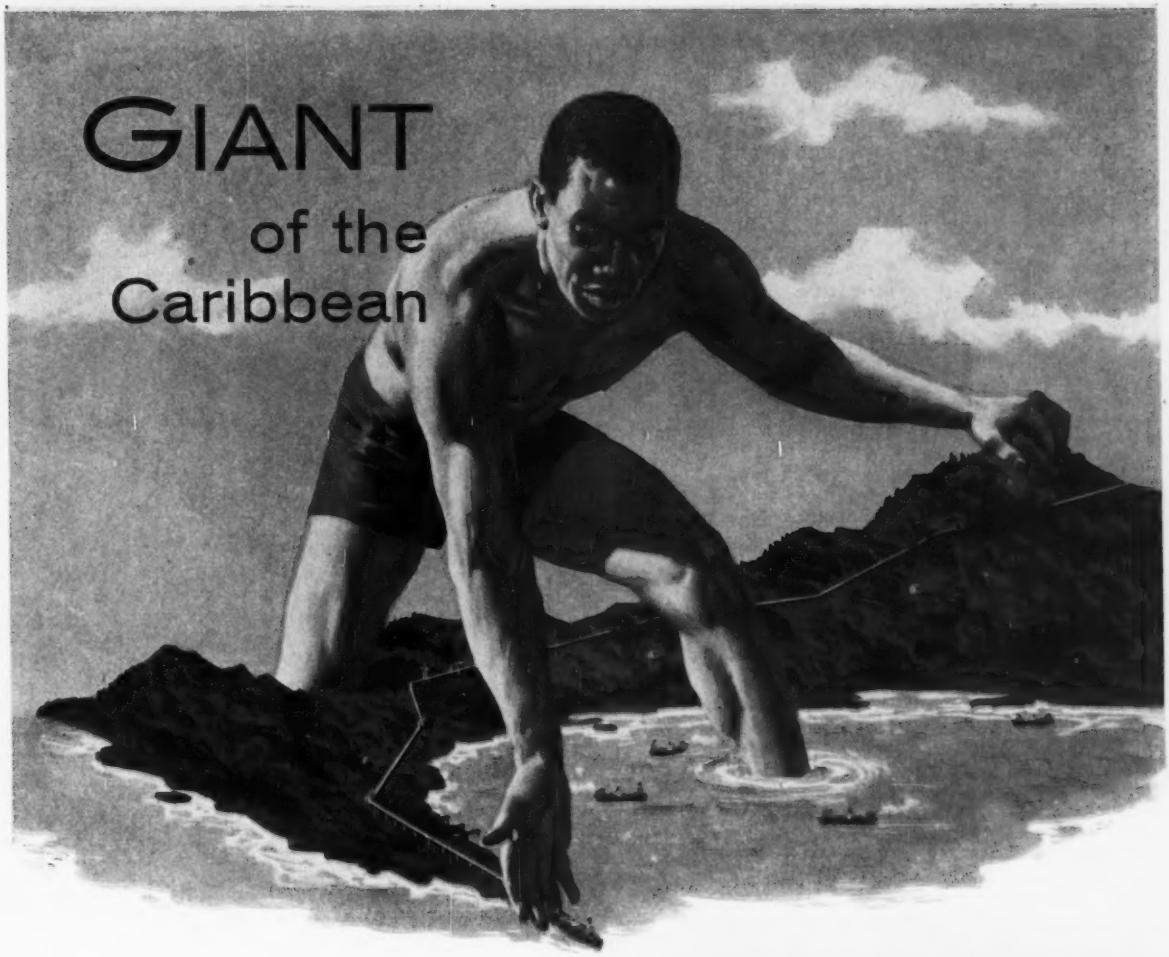
A more definitive screening method still is sorely needed and demands continued research. Even geochemistry, the most promising means, was found wanting by Inco (AMC Mtg, Parker).

The concept that a broad exploration program will pay off is confirmed by the U.S. Dept. of Interior's report on DMEA activities to June 1957. Some $23 of minerals were found for each total dollar invested by the joint (50/50) partnership of Government and private interests.

Geology is finding its latest aid in aerial photography. The 3-D projection-type models are especially useful for structural studies. When coupled with computers they are a rapid means of calculating topographic corrections for gravimetric work. Color and camouflage-detection films have advantages over black-and-white for revealing rock variations but they cost two or three times as much, though the price is dropping. A partial solution involves using color-filters in black-and-white photography (*WM&OR* Jan & Mar 58).

Tectonic model and related rock mechanics studies are gaining wider interest. The unique brittleness of dolomite under pressure is one find-

US RUBBER CONVEYOR BELTS



In Jamaica, B.W.I., moving a million and a half tons of bauxite a year from back up in the hills to port loading facilities is a tough, complicated job. Climate, rough terrain, abrasion, great distances—all have to be overcome. Reynolds Metals Co. moves its bauxite production underground and overland on dozens of "U.S." Belts... first as cold, sticky, abrasive run-of-mine ore, later as crushed fines right from red-hot drying kilns.

"U.S." belting engineers, working closely with engineers of the conveyor system and of Reynolds, selected and designed the belts to handle the many different problems of movement and material. It's this specialized belting "know-how", plus the finest product available, that assures you of the right belt for the job every time.

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ing (*ME* Feb58). These studies will undoubtedly influence the evaluation of lateral secretion vs. magmatic theories of ore genesis. The substantial evidence that crustal flaws carry over through long periods of time, is another factor that is focusing attention on tectonics.

As an over-all observation, it is apparent from literature that the two basic guides in exploration remain structure and genesis. Structure—including lithology—controls localization and hence is the most practical prospecting guide; while genesis is the areal or strategic guide.

Yardley's sun compass technique for sketch mapping in strongly magnetic areas is a simple, handy aid that warrants wider use (*CMJ* May58).

Geochemistry and mineralogy developments include: fast, simple mineral identification involving photometer measurement of light reflection from a polished surface and an indentation hardness test (*MgM* Dec58); rapid semi-quantitive chemical analysis of mineral streaks (*MgM* Sep57); continued progress in trace-element and isotope-ratio relationships; and improvements in X-ray spectography, polarographic and solvent-extraction analytical techniques. Absolute age dating based on isotope ratios is forcing reconsideration of a number of genetic theories.

Geophysics for mining exploration finds its newest method to be one which measures "the tilt of the plane of polarization of the natural magnetic fields in the audio frequency spectrum." This "AFMAG" method uses only a 30-lb receiving apparatus and "can be considered as a magnetometer capable of detecting conductive bodies rather than magnetic bodies". (*CMM Bull* Aug58).

An improved fixed-wing aerial EM scheme permits faster flying and greater depth penetration from higher altitudes. A second rear plane transmits a circularly polarized field from two rotating coils which are at right angles to each other with their common axis in the flight direction; and the front receiver plane uses a bird on a short cable, in which are two similarly oriented but non-rotating coils. Orientation and spacing is not too critical (*GpP* Feb58).

Of course the success of the helicopter EM scheme first used in New Brunswick still makes headlines. It uses fixed coils. A low ratio of in-phase to out-of-phase (quadrature) values has been found indicative of graphitic zones rather than sulphides.

Some geophysical "hardware" news includes development of:

nuclear resonance and improved older types of magnetometers into quick-reading, easily-carried hand units;

drillhole magnetometers and EM units (Expl Drill Sym UMin 57);

an inter-hole EM apparatus with a range of 1,000 ft using 10-50 m wave length and a 20 watt transmitter (Russian announcement);

an airborne gravimeter using two suspended masses to eliminate motion and some topographic effects (Lundberg);

improved seismic apparatus for shallow work and for non-explosive work;

a continuous-recording directional scintillometer using a cylindrical crystal with a slotted-shield rotating at 10 rpm (Geneva Conf 1958);

a beryllium field-detector using a radioactive exciting source and a scintillometer to pick up induced emanations (SEcG Mtg58)—a similar device works as a drilling guide in coal (NCB announcement).

As for newer techniques, geothermal surveying seems to be of interest in prospecting for ores, especially uranium, and hydrocarbons, because of production or conduction of heat (ExDrill Sym UMinn57). Another "hot" topic was the care needed in radiometric probing to prevent errors from daughter products, hole chambering, mud shielding, et al. (WymMACon58).

Valuation, or specifically sampling, advances are probably led by improvements in recovering core in weakly-bonded ground. Two techniques are: the use of chilled diesel oil as flushing medium to freeze ground below the water table; and promising tests of quick-setting chemical gels and resin that can be intermittently injected through the flushing system to consolidate or seal weak or wet ground—they also permit air-flush rotary drilling in wet ground.

Recent mechanical apparatus that improves core recovery include:

the wireline core-barrel, originally only aimed at cutting rod-pulling;

a chrome-plated inner tube to reduce friction and wedging and a pilot-type bit with no flushing-medium outlet on the tip of the pilot, which is used with a swivel-tube core barrel that has straight walls and no core lifter (Christensen);

a dry, rotary core drill with long single-pice kelly (MidAmerConf, Drescher);

and, most recently, a "rubber sleeved" core barrel (AMC Mtg, Burnhart).

Some other recent exploration drilling news is:

continued work on diamond bit design such as the USBM finding that large high-grade diamonds in a round crown are most economical in sandstone while small low-grade stones in a flat crown given lower costs in limestones:

larger strong diamond drill rods;

small pack-carried, rotary and percussion drills;

a handheld soil sampling auger for holes 4 in. x up to 20 ft (*MJ* Jan 24,58);

a water-jet type of beach-sand sampling drill (*E&MJ* Mar58 NPD);

a highly versatile wagon-mounted drill for water-jet or rotary (including diamond core and auger drilling with suction or pressure, reverse or normal flushing (*E&MJ* Feb59 NPD);

miniature gyrocompasses and other dip and azimuth hole surveying apparatus including continuous recorders (ExDrillSym UMinn57);

and the wider use of statistical mathematics in planning hole spacing in analyzing core.

Hole drift cropped up as a major problem in the Ambrosia Lake district where it has been as high as 200 ft in 500 ft with rotary drills. Some answers were found in slow feed, weighted collars and stabilizing agents. (WyoMA Con58).

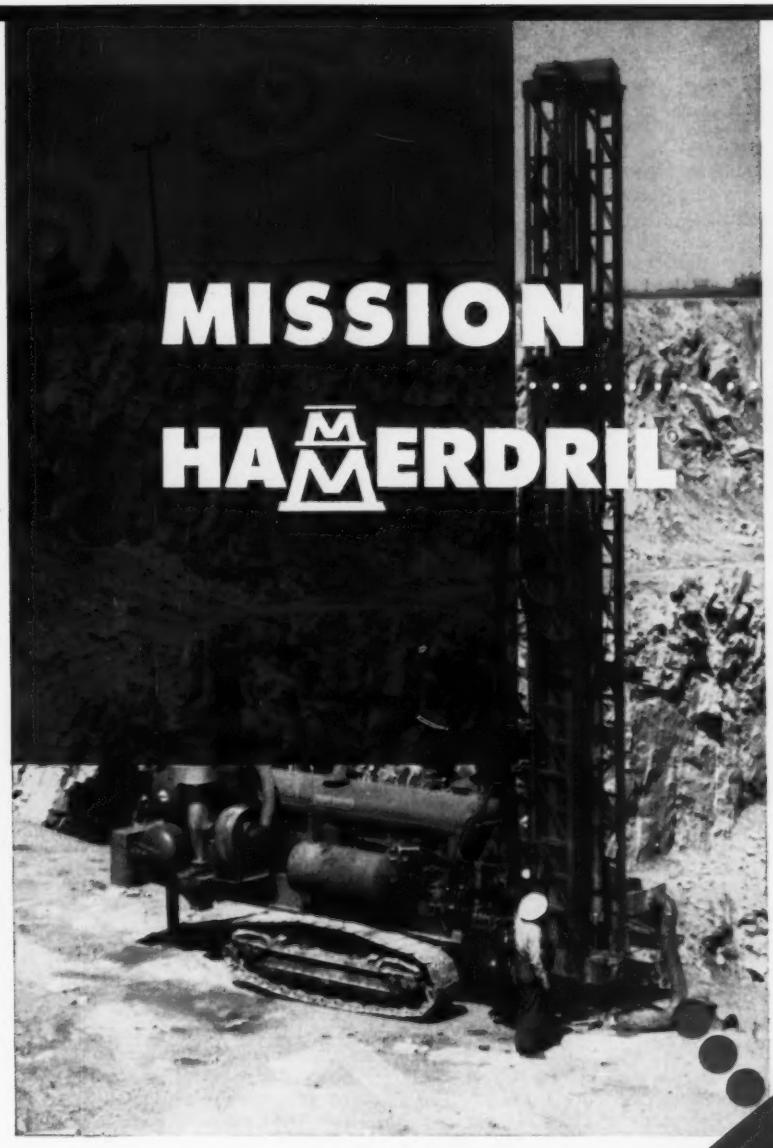
Costs of drilling were discussed at the Wyoming meeting. They can be summarized as: (per ft)

Rotary for probing	$0.50-1
Rotary for air-chips	1-2
Churn for sludge (cased)	—
Bucket auger (15-in. dia)	1-10
Coring, pilot bit & mud	17.50
Coring, oil freeze (100% rcvy)	20

Reliable commercial assay costs $2-5 per sample.

Trends in Mining

MINING PRACTICE continues its trend toward surface mining. The cost advantage of surface excavation as compared to underground excavation is on the order of 3 to 1. Simplicity of method, more efficient machines,



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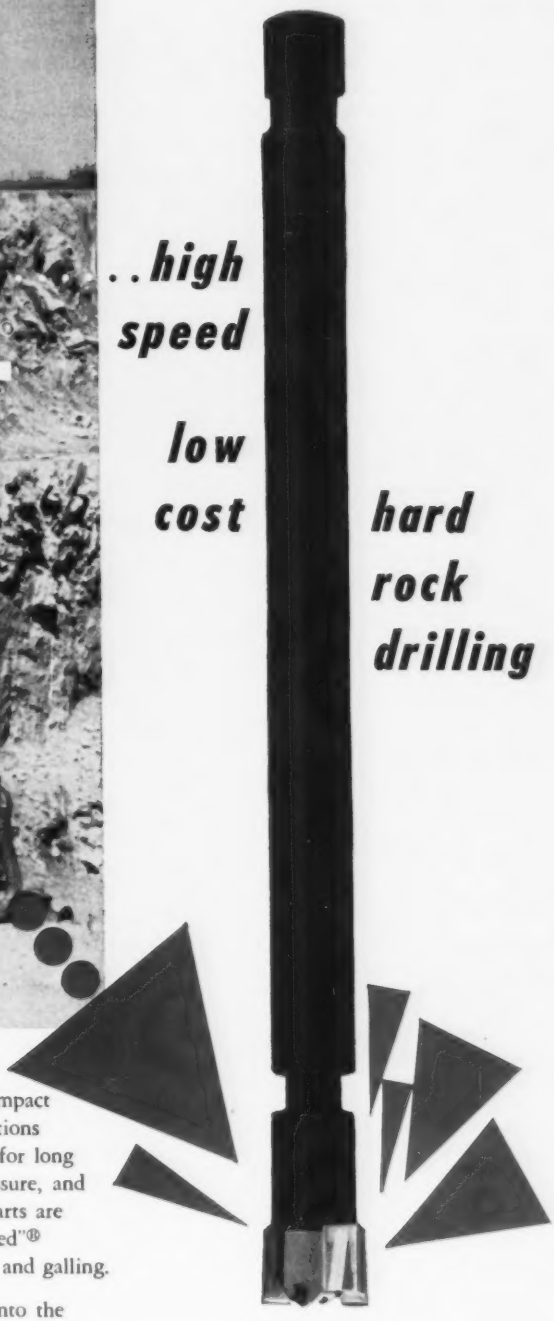

Patents Issued And Pending

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58—901

more complete recovery, easier selective mining, and more acceptable working conditions for labor all are factors.

Another trend that is standing the test of time is the use of specialized development contractors—many from the construction field—for fast stripping and shaft-sinking. If not cheaper outright, they certainly save interest charges and/or capital tie-up.

WELL MINING is news this year as Freeport Sulphur progresses with their Grand Isle off-shore project. The Y-shaped island of piles, steel and concrete is being built seven miles out in the Gulf of Mexico in 50 ft of water. Sulphur at about 2,000 ft will be extracted through several holes using the Frasch hot-water-melting process. Seawater rather than fresh will be heated—about 5,000,000 gpd to 325 deg F—using natural gas from a nearby well. Molten sulphur will be shipped to shore in insulated barges.

SURFACE MINING is maintaining its low costs in a number of ways in spite of seemingly outrageous depths —800 ft planned at Pima—and waste to ore ratios—actually 78:1 (tons, overburden plus waste) at Continental Uranium and 45 yd: 1 ton planned at Lucky Mc Uranium. For depth, the logical answer is truck haulage with skip hoisting, e.g., Kennecott Copper and Steep Rock Iron.

For Stripping, as well as opencast mining of weakly-bonded material, the cost cutting answers are hydraulic methods wherever possible and bigger and more efficient machines. A list of known big earthmovers includes: the 3,700 cu yd per hr suction dredge at Steep Rock; the 2,000 yd per hr bucketwheel excavator at Nchanga copper and a 5,000-yd per hr unit in German coal; the 1,600-yd per hr dry bucketline dredge in Australian coal; the 30-yd dragline crane on the Mesabi; the 36-yd wheeled scrapers at Pima; the 70-yd casting-type dipper shovel at Peabody coal; and the 60-yd semi-trailer trucks at several non-metallic and coal pits.

Notable new units in 1958 were: a 7,500 plus cu yd per hr bucketwheel being built by Krupp in Germany; the 70- and 130-ton electric-wheel-driven scrapers unveiled by R. G. LeTourneau; and the 100-yd struck, 165-ton payload, 1000-hp rear dump truck built by Western Contracting Corp. on the Oahe dam.

Some smaller models of the more continuously acting excavators are also proving their worth. Some examples are: a tiny portable suction dredging unit (Denver Equip); a small floating suction dredge with central ladder (Daniels); and small bucketwheel and bucketline dry excavators (Bucyrus-Erie).

Two other handy smaller muckers are: the crawler and wheeled front-end loaders up to 4-yd; and the Gradall unit which is a crawler or wheeled vehicle with a hoe-like scoop on the end of a long extensible, twistable and rotatable arm.

Of course in hard material, the drill-explosive-shovel-truck team remains the leader. But in many cases, tractor-rippers are proving they can outperform the first two and then a scraper can often be used to replace the last two (*E&MJ* Oct58).

Two unique tools that gave good first-year performances were: a city road-sweeper to clean off the last traces of soil from an industrial mineral deposit; and a 3,000-tpd mining-milling unit for producing minus 1-in. agricultural gypsum, mounted on wheels, it drives across the pit while digging, screening, crushing and windrowing or loading into trucks (*E&MJ* Jan59).

Pit Production also marches on toward bigger equipment. In rock work, a major development is the almost universal use of high ammonium nitrate explosives. And certainly practice has been marked in recent years by the emergence of truck haulage as the principal method. Only the very large, very shallow or older pits remain as the fields for rail haulage. Even in these, a considerable number of trucks are used for handling waste and opening new benches. Belt conveying is also increasing.

In breaking, the trend is to large holes. They save set-up and moving time, permit safer large outside burdens, are advantageous in blasting —especially with ammonium nitrate, and permit use of more rugged bits in rotary drilling.

Drilling at inclinations all the way from off-vertical through off-horizontal to up-holes is another trend. It permits concentrating blasting in hard layers. With slightly inclined holes—15 to 20 deg off vertical—the advantages of better fragmentation, less back break and no or less need for bottom-chambering and/or sub-drilling have been cited as completely overriding the slight loss in penetration speed. Near-horizontal holes allow long-hole and one-level work—powder charging difficulties are being solved with mechanical devices. Up-holes have been used when very high benches are absolutely necessary—e.g., in the Alps—but the dog-hole excavation and explosive charging are formidable obstacles. Coyote-tunnel blasting might be considered here. It apparently can give good results if large boulders can be accommodated.

UNDERGROUND MINING reached a new depth record in May—11,003 ft. below the surface in a winze at East Rand Proprietary Mines in the Transvaal. At this point, one mile below sea level, rock temperature is 123 deg. F. Likewise after gold, the ultra-deep mines in India's Kolar Field are well below 10,000 ft. Increasing depths in these and other districts around the world are causing wider interest in cooling methods.

In general, practice is leaning more and more heavily on longer drillholes, on trackless muck handling equipment and on all-mechanical breaking and handling units.

Development is a particularly desirable field for all-mechanical breaking because it eliminates the cyclic program and the blast damage to walls. (Of course, blast damage can be reduced by an "air-cushion" of closely spaced drillholes but it is costly.) A wide variety of coring and full-face-cutting machines have been used for up, down and lateral work. Some are self-propelled—even for raises—but others, for smaller openings especially, are lowered on a wire rope, pushed by a rod, or pulled by a wire rope in a pilot hole. Sizes have generally been under 6 ft in maximum dimension but many are feasible for larger sizes and some have made plus 20-ft. openings. (See *E&MJ* Mid-Jun56, Feb & Oct57). Hard limestone and some sandstone formations have been successfully penetrated by several of the machines, e.g., at Steep Rock iron and on several sewer projects.

To cut the rock, one major group of machines uses a continuously scraping action, the other uses an intermittent picking action—although on closer examination both cause intermittent chipping failure. Some full face boring units perform like corers in cutting concentric grooves which then permit more efficient action of an outward-wedging sliding component or a top-pressing rolling disk to break down the lands. For cutting harder rocks, the intermittent picking, toothed-roller-bit cone is perhaps on the ascendancy—especially if tungsten carbide button inserts are used for the teeth. For top-pressing rolling

B.F.Goodrich

Traction Express tires give coal hauler up to 90,000 miles before retreading

THAT hopper-bottom trailer has just emerged from a coal-loading tunnel at Guntersville, Ala., ready for the 75-mile trip to Rome, Ga. It's one of a fleet owned by the Coal Transportation Co. that works 18 hours a day, 6 days a week, hauling 20-ton loads over winding, mountainous roads.

"We have a hauling job that is particularly hard on tires," says President Taft Chatham, "but we find B.F.Goodrich Traction Express tires give better service than any other make we have ever used!" Traction Express tires give this company up to 90,000 original miles—then 2 retreads! Blowouts and tread separations are almost unknown!

Like all B.F.Goodrich tires for mine work, the Traction Express is built with a FLEX-RITE NYLON cord body. B.F.Goodrich FLEX-RITE NYLON withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder this B.F.Goodrich construction outwears even the extra-thick Traction Express tread, can often be retreaded again and again.

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B.F.Goodrich *truck tires*

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disks, a notched design has proven efficient in hard rocks. But just using the disks alone, without grooving, seems to be the most suitable means of penetrating the harder rocks.

In shaft and winze sinking by conventional drilling and blasting, the major effort has been to develop faster, more efficient mechanical muckers. Once again there is a variety of machines: overcast loaders, bridge cranes, cableways, underslung gantry cranes and an arm-and-hand-like rigid grab-boom—(see *E&MJ* Mid-Jun57). The grab buckets themselves range through clamshells and orangepeels from 5- to 20-cu ft capacity with cable, pneumatic or hydraulic closing devices. Steel-framed aluminum grab and sinking buckets are a newer item.

For drilling, umbrella-like collapsible multi-drill jumbos are widely used. Such a jumbo for four air-leg machines was used in conjunction with a small rigid grab-boom, a special high-speed hoisting skip, and a fast ventilating system to sink a 7x13x850-ft shaft at up to 24 ft per day (*E&MJ* Dec58).

On shallower shafts, pre-drilling with longholes and blasting in short steps is another recent approach—9 in. churn drilling at Hanna Coal.

On large, ultra-deep shafts a special winding arrangement for the sinking stage has been devised. It uses a multi-wrap friction drive and an auxiliary storage drum hoist (*E&MJ* Nov56 Op1).

Permanent headframes are being used for sinking on more and more projects. The trend toward concrete towers seems slowed—perhaps steel frames are lowest cost unless silo construction (only mesh reinforcing and sliding forms) is used.

Circular-section shafts are common. In addition to their inherent strength, they simplify form work when lining with concrete. A low-cost 7-ft inside dia shaft was lined with corrugated drainage plate sections for the top 55 ft; then at 6-ft intervals during sinking, 18-in. sections were set on the muck and concreted in place (Mid-Continent Uranium, New Mexico). Coal Mines in the Rhineland are making interesting use of hot-placed coal-tar pitch as a waterproof, yielding cushion behind an inner shaft lining or between double linings of brick, concrete or steel. Such construction is used through subsidence-prone surface material and permits smaller shaft pillars. In such loose ground, brine-freezing, gel- and concrete-grouting and drop-caisson work is common for sinking.

One of the most unusual new shafts is Potash Corp. of America's in Saskatchewan. The 16x3,450-ft circular shaft is designed for 4,000 tpd using a tower-mounted friction hoist. The loose, wet surface cover was penetrated by a drop-shaft scheme. This ground and deeper rock was stabilized by brine-freezing pipes. The shaft is concrete lined but has no dividers. Skip guides are free-hanging, 1¾-in. locked-coil wire ropes with weights on the bottom end. Rigid guides are used at loading and dumping stations. The skip loader supervises the semi-automatic hoisting. Ventilation air is forced down through a lens-shaped area formed by the shaft-lining and arch-panels of plastic-bonded fiber glass.

As for sinking rates, crews now have to shoot for over 300 ft per month just to be called fast — to break the record they have to better last year's 834 ft per month at Free State Saaiplaas.

In adits, tunnels, drifts and crosscuts, driving rates of over 60 ft per day are becoming commonplace using more-or-less conventional methods. But Iron Curtain reports of double (even nine times!) that are unsubstantiated. Once again faster muck handling has been a main approach (*E&MJ* Mid-Jun56&58). One system that continues to get headlines uses a crawler-mounted over-cast loader which dumps into the first car of a train from which the muck is moved toward the rear by a slusher riding in an angle on the lip of the cars and riding over intra-car rails and inter-car aprons. The conveyor-bottom, open-end, apron-joined, long, articulated train from Germany also attracts considerable attention. Other schemes involve various loaders with long tail aprons or belt conveyors and several kinds of car transfers and switches.

For breaking, longer rounds made possible by large-hole burncuts are notable. If several blank holes up to 3-in. or so in diameter are used, conventional drill machines are satisfactory for advancing an over-sized bit or a reamer. But as the blank holes get larger such drilling becomes inefficient. For a single 8-in. blank hole in a 12-ft deep 48-hole round, a surface-type down-the-hole unit was used on the West Delaware Aqueduct in New York. It was mounted at the center of a jumbo and surrounded by six boom-mounted drifters.

From Japan, "no-cut" or crater blasting is offered as an efficient, low-cost, long round. The explosive is concentrated at the bottom of several closely spaced holes and detonated simultaneously. Trimmer holes dress up the crater (ColoSym56).

In raising, predrilling with long holes and blasting in longer lifts is customary at several foreign properties. For such work, large-hole burncut patterns predominate and most drilling is done down (*E&MJ* Oct57; *M&QE* Aug-Oct57).

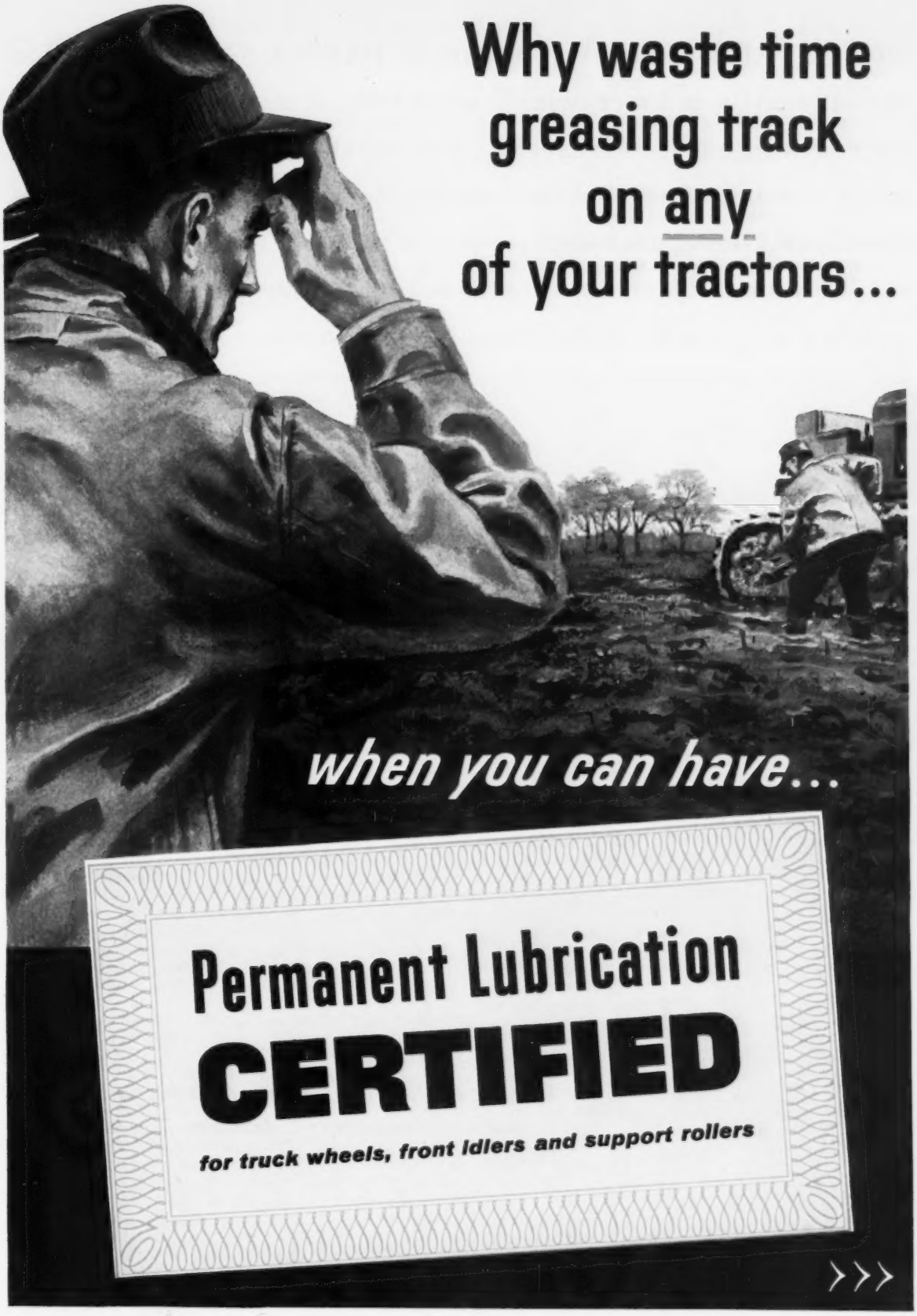
Cage-raising has perhaps gotten the biggest headlines lately. The method involves drilling a hole on the centerline and using a winch and wire rope to lift or drag a drilling platform up to the face. A conductor-cored suspension rope for communication and an uncased hole large enough for air, water and blasting lines are recent recommendations (Resurrection Mining Co., Colo.). Safety sprags are common on the cages.

An elevating platform mounted on a cog-wheeled carrier riding an extensible sectional monorail which is anchor-bolted to one wall, is a clever development in Sweden, e.g., Kiruna (D&BSym UMinn58). The air-operated unit is moved around on a rubber-tired wagon. After drilling and charging is finished, the platform can be run down and swung out of the way under the brow at the bottom. The monorail is usually left in place without damaging results.

Production methods in underground mining are difficult to consider in the nice old groups. Operators are trying many new combinations and permutations of the traditional methods and quickly adding new "wrinkles" (*E&MJ* Feb57). Methods long confined to coal have been adopted in mining other minerals, e.g., longwall caving at Hecla's uranium mine in Utah, and regular room-and-pillar layouts for all-mechanical breaking and handling in saline deposits. Even hydraulicking has gone underground, e.g., mining soft dike material at Treasure State's Pb-Zn-Ag mine in Montana, mining weak brittle gilsonite in Utah, and mining coal in Russia and Australia.

These successes are spurring others to reexamine their practice and tailor their mining to more closely fit the orebody's particular orientation, relative dimensions and regularity of boundaries, as well as the ore's value and structure (including grade variation and strength) and the country rock's structure and need to remain intact.

Vertical slicing, rather than either a horizontal or rill slicing, has been a recently favored approach to mining steeply dipping tabular orebodies. It is well established in longhole sublevel stoping practice, and now with short holes it is being applied to open-irregular-pillar, cut-&-fill and square set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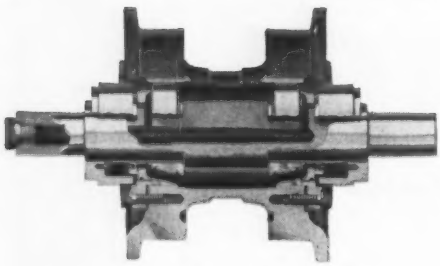

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stoping with overhand, underhand and breast drilling variations. Better ground support is one of its principal advantages. The latest wrinkle is to make access to the face easier by using a wire rope suspended cage or skid — like in cage-raising—which serves as a drilling platform for slicing up-dip with short horizontal holes (Stoces' book).

Longwall caving on the retreat from ore boundaries to the shaft gives complete extraction and great safety in thin flat orebodies where the roof need not be kept intact. Although a fairly weak roof is desirable, a strong roof can be weakened by drilling and blasting. Rock bursts are reduced because of the elimination of remnant projections or pillars. Now some operators are reportedly considering this method but substituting horizontal longholes for the customary shortholes —in spite of the increased hazard of blast damage to yieldable props and timber cribs. The promising development of coal plows into hard rock work might convert the process to all-mechanical. The several types of self-advancing props further this approach.

In longwall and sublevel caving, a flexible mat of steel mesh is an interesting suggestion for cutting dilution and simplifying support of the caving overburden. It is rumored that Kiruna iron in Sweden is testing this for use with their two-drill rubber-tired jumbos, mobile compressors, gathering-arm-and-conveyor loaders, and conveyor-bottom shuttle cars on the sublevels.

Top heading-and-bench mining on a long regular-room-and-pillar plan apparently is the low-cost, high-rate production method in thick flat orebodies with strong roofs. It has been adopted by contractors to excavate large tunnels and chambers for hydroelectric installations in Sweden and for petroleum product storage in the U.S. Riverside Cement mines 60-ft wide rooms in limestone with a heading and two down-hole benches each 30 ft high in an area down dip from their now abandoned block-caving stopes. On a smaller scale and often with breast-hole benches, the scheme is widely used in Mississippi Valley lead-zinc mines in limestone. Outokumpu copper in Finland uses a 9x21-ft heading with a single 50-ft down-hole bench.

On the other hand, a shrinkage stoping variation of regular-room-and-pillar mining under similar conditions can give rock-bottom costs and still keep the roof under close observation while breaking. Tri-State Zinc, Ill., uses such a scheme on a 40-ft square plan, stoping across several rooms in line in one operation.

Drill jumbos with plus-12-ft feeds and dipper shovels with short booms are cost-cutting equipment in this work, although the wheeled front-end loader is giving remarkable performances.

Pillar robbing is especially desirable in valuable ores and is being tackled by: extensive use of rockbolts (placed from an extensible tower) with conventional breaking and handling at St. Joseph Lead in Missouri; and a dragline crane to gather drilled and blasted muck at Standard Uranium in Utah. Slushers also serve for muck gathering in inaccessible areas: a triple drum hoist with tail sheaves outside the area; a double drum hoist with the single sheave remotely recoverable through the use of a long wire rope attached to the sheave hook, run through or around an expendable anchor and anchored near the hoist. Outokumpu fills rooms with a weak concrete and then mines the pillars the same as the rooms (see above). In a New York salt mine, a remote-controlled continuous miner makes pillaring "man-safer."

Cut-and-fill stoping has been improved by rockbolting and hydraulic sand-filling. A 55-70% solids slurry of plus-10-micron mill tailings results in an inexpensive, outstandingly strong, compression-resistant fill that consolidates rapidly and minimizes run-off (MontSym58). It can be placed fast with a minimum of labor using holes drilled from the surface, rubber-lined pipe and large hose—but up-grades should be in vertical steps, curves should be gradual. Sand dams —built in 1-ft layers concurrently with filling—is a simple way of avoiding costly timber barricades (Broken Hill, Australia). Pneumatic placement of fine damp fill has attracted attention because it has a high angle of repose, is well packed and has no water run-off. An intermittent-acting air-gun at Rio Tinto in Spain has cut air costs—movement of material to the gun is by belt or shaker conveyor (*E&MJ* Oct57).

In shrinkage stoping, longhole drilling does not change its wall supporting character but the working-place is moved to the safer confines of an auxiliary raise or chamber alongside the manway. As in longhole sublevel stoping, the inherent efficiency of parallel holes must be balanced against the less preparation needed with fanned holes. Fanned holes seemed to be preferred and while they permit following some wall irregularity, they raise the hazard of overdrilling which may result in dilution and weakening of walls.

A method of coyote-like "powder blasting" from a grid of drifts and crosscuts long served as an efficient (0.6 lb per ton powder factor) variation of shrinkage stoping for Brittania Mining in British Columbia. It probably requires a pronounced contrast in ore and country rock strength.

Shrinkage and sub-level stope bottoms are being designed in new ways. If draw funnels wear excessively, one alternative is a "continuous trough" with its bottom at the same elevation as an adjacent haulage drift in the ore pillar or wall rock. Muck is allowed to build its own funnel; but tailings fill has also been used to form the funnels. "Draw point loading" is used, i.e., short crosscuts for shuttling loaders. Even with funnels excavated in the normal manner, draw point loading eliminates the installation and maintenance costs of overhead chutes. Crawler loaders eliminate the need for special turntables, switches or dollies to move rail-mounted types. The newer wheeled models would probably be even better.

In block caving, complete excavation of the undercut and draw funnels by drilling upwards in a fan pattern from the safety of the ore gathering or grizzly control drifts, is a growing practice. It may also be in use for excavating sub-level draw-funnels and thereby eliminating one sub. Essentially it involves careful orientation, charging and timing of moderately long blastholes. For gathering muck that caves or is "grizzled" fine enough, belt conveyors are being used increasingly. The rope-suspended belt is proving ideal for this work—fast, easy installation and moving and good shock absorbent characteristics, e.g., Cleveland-Cliffs Iron's Mather mine in Michigan.

[Part II, in March, will give more details on surface and underground mining practice.]

Key to References: AMC Mtg—American Mining Congress Meeting 1958; CIMM Mtg—Ca. Inst. of Mining & Metallurgy 1958; *CMJ—Canadian Mining Journal; CMM Bull — Ca. Mining & Metallurgy Bulletin* (CIMM); ColoSym56—Symposium on Rock Mechanics, Colo. School of Mines, 1956; D&BSym UMinn58—Drilling & Blasting Symposium, Univ. of Minn., 1958; ExDrillSym UMinn57—Exploration Drilling Symposium, Univ. of Minn., 1957; *GpP—Geophysical Prospecting; M&QE—Mine & Quarry Engineering* (London); *MCJ—Mining Congress Journal; ME—Mining Engineering* (AIME); *MgM—Mining Magazine* (London); MidAmerConf—Mid-America Minerals Conference 1958 (AIME, et al); *MJ—Mining Journal* (London); MontSym58—Symposium on Hydraulic Stope Fill, Montana School of Mines, 1958; MSMSym58—Symposium on Mining Research, Missouri School of Mines, 1958; NCB—National Coal Board, Great Britain; NPD—New Products Digest Department *E&MJ;* OpI—Operating Ideas Department *E&MJ;* SEcG Mtg58—Society of Economic Geologists; *Skilling's—Skilling's Mining Review;* Stoces' book—Stoces, B., & Hosemann, D.: *Underground Mining Methods* (in German), Ferdinand Enke Verlag, Stuttgart, Germany, 1958; *WM&OR—Western Miner & Oil Review;* WyoMA Con58—Wyoming Mining Association Conference

OPERATING IDEAS

Light-Weight Jacks Simplify the Recovery of Roof Bolts

BY USING TWO JACKS (Simplex M279), roof bolt recovery becomes a simple, safe, and easy operation, according to Templeton, Kenly & Co. Each roof bolt recovery jack has a 24-in. rack bar travel. Weight is only 36 lb for a 72-in. minimum jack size. Column and all castings are made of high strength aluminum alloy which makes the unit easy to handle and easy to see in the dim light of most mines. Write to Templeton, Kenly & Co., 2535 Gardner Road, Broadview, Ill.

New Tooth Extends Bucket Life

A STEEL TOOTH BUILT into high-lift tractor buckets has eased the scooping up of semi-molten slag under and around the furnaces at U.S. Steel's Homestead plant.

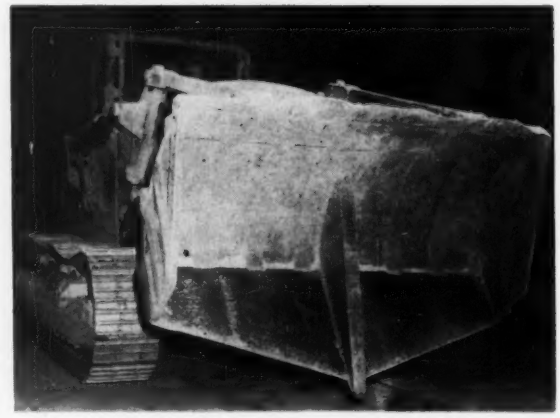
The "T-1" tooth (made from high-yield-strength constructional alloy steel), combined with a prow-shaped bucket lip made of the same material, has extended bucket life by at least 400% and has reduced bucket costs by two-thirds.

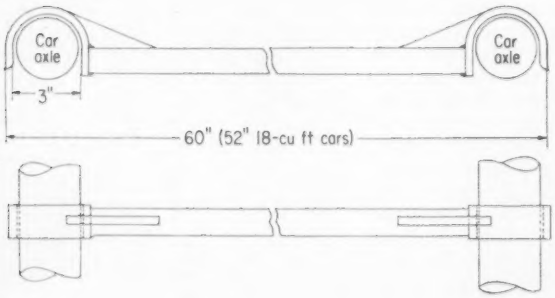
In the past, the straight lip of a bucket made from ordinary steel often could not dig into the hot slag without subjecting both bucket and tractor to excessive stresses. Homestead then tried "T-1" steel in the bucket lip, shaping it into a shallow "V." After welding the new lip, the wedge-shaped tooth was added, the widest part being welded to the back of the bucket for strength.

The V-shaped lip and wedged-shaped tooth have solved the problem. Since the tooth is positioned in the center of the bucket, stresses are evenly distributed to the tractor's high-lift mechanism as the bucket digs into the slag.

"T-1"'s resistance to abrasion enabled the lip and tooth of the first modified bucket to survive three months of rugged operating conditions without failure.

Frank J. Barsic, maintenance general foreman in the Homestead transportation and general services department, said that "it costs us bout $1,100 for material and labor to change each bucket. At this point, we don't know how long a bucket will last, but the first one has lasted four times as long as the conventional bucket and is still in good shape."





Simple Rod Speeds Car Coupling

A SIMPLE CAR COUPLING rod has speeded the distribution of empty cars to loading points, the moving of loaded cars to train assembly centers, and haulage operations in general at Cordero Mining Co.'s quicksilver operations near McDermitt, Nevada.

The rod can easily be made at any mine machine shop from short lengths of either used pipe or steel bars. The hook unit and steel brace at each end of the rod are welded on. Inside diameter of the hook is slightly larger than that of the car axle, permitting quick placing of the coupling rod between car axles when assembling an ore or waste train. Rod length for use on 24-cubic ft mine cars is 60-in. and, for 18-cubic ft cars, 52-in.

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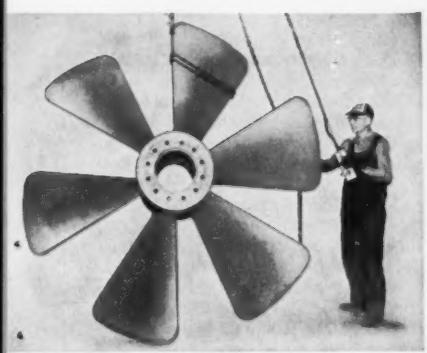

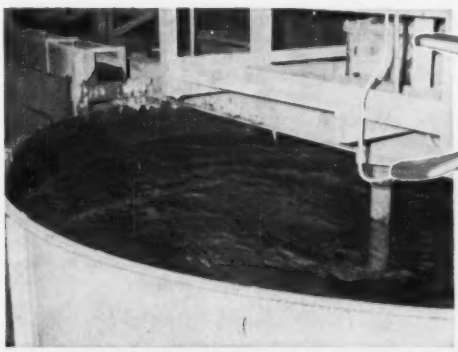

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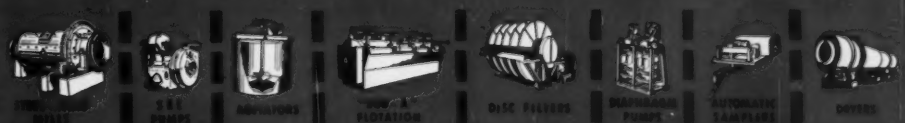


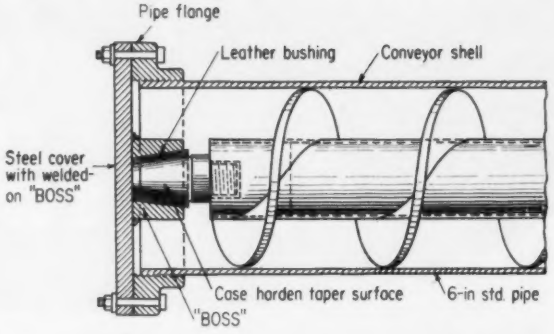
OPERATING IDEAS *(Continued)*

New Bearing Cuts Conveyor Loss

A REDESIGNED SCREW CONVEYOR FOOT BEARING gave longer service and minimized conveyor shutdowns at Empire Star Mines Co., Ltd., Grass Valley, Calif.

Concentrates pumped from the mill to the cyanide plant were dewatered and elevated by the conveyor to the bowl classifier ahead of the cyanide circuit. The bronze bushing bearing formerly used failed after only one month of operation regardless of attempts to lubricate it with special grease. In fact, the lubrication schemes were actually a detriment to subsequent treatment of the concentrates.

The new bearing assembly, devised by Phil Keast, master mechanic, has given satisfactory service, and has an average operating life of more than 4 months. It consists of a "boss" (bored out to a taper of one-in. per ft) welded on to the end cover of the conveyor shell, and a conical bushing made at the shop from leather used for check valve flaps. An extra bearing unit is available at all times and a changeover requires only a few minutes.



Wagon Speeds Mine Repair Work

THE EFFICIENCY AND MOBILITY of an underground maintenance shop can be greatly improved by having tools and materials stored on a large wagon, according to an article in the March 1958 edition of U.S. Potash Co.'s magazine, *Pioneer*.

In stressing the importance of shop mobility at its own operations, the company said that "this aspect of the department has been a natural evolution over the years as mining activities moved further and further from the main shop. . . ."

To assure continued operation during the final mining phases, the company maintained complete shops in both working areas. The shop sites were moved every two months as the mining retreat line caught up to them. "Now, instead of having to round up all of the shop's equipment and load it on buggies for the move to the next shop location, all that is necessary is to hook onto the wagon and proceed to the new site."

Jointless Welded Rail Improves Ride; Cuts Car Damage

THE DEVELOPMENT of fast, economical methods of welding long, continuous sections of rail has done away with many of the headaches of car and track maintenance, according to the National Cylinder Gas Div., Chemtron Corp.

Bolted rail joints, which are said to require 50% of trackmen's attention, suffer constant pounding from heavy loads that cause joint failures which shorten service life. Welded joints, on the other hand, are as strong or stronger than the track itself.

Some of the advantages of the continuous rail include:

—lower rail maintenance costs.
—longer rail service life.
—longer life for ties.
—elimination of joint bar and bolt replacement.
—improved signal circuit operation.
—less shock to rolling stock.

The NCG rail welding system includes rail handling equipment mounted on a single car, welder and grinder on a separate 60-ft, 70-ton welding car, and an optional 50-ft, 50-ton car containing power generating equipment.

At the job-site, cars are parked in semi-permanent locations where single sections of rail can be fed into the welder, emerging as continuous-welded rail, and loaded onto a string of flat cars. Continuous lengths a quarter-mile or more long can be welded and loaded onto a long train of flat cars. These can transport as many as 48 stacked lengths to the desired track site, where unloading is done by the relatively simple method of anchoring one end of the rail and pulling the train out from under one or two rails at a time.

Welding operation requires a maximum of 700 KVA power on a 15% duty cycle, with an auxiliary load of 175 KVA to run air compressors, cooling units, lighting and other equipment. Where sufficient commercial power is not available, the NCG mobile power car containing 860-horsepower diesel engine driving a 480-volt, three-phase, 60-cycle, 640 KVC generator develops power for welding machine.

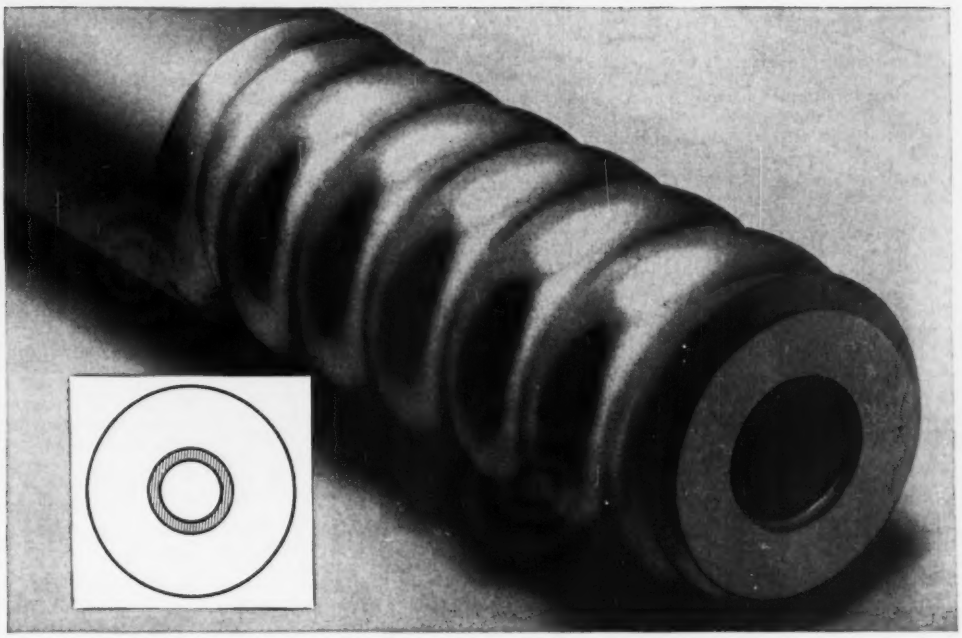
Special design features of the unit include automatic handling and grinding equipment to prepare rail and feed it to the welder; automatic equipment that grinds excess metal from completed welds as the rail moves along the production line; "feelers" triggering electronic instruments that control the movement of rail through welding and grinding stages, and an automatic shear block incorporated in the welding machine itself to immediately trim red-hot excess metal after each weld. One-man control for the entire operation is provided by electronic controls at the welding machine.

Full electric power is applied as the rails are brought into contact with each other over a series of pre-heating cycles of less than three seconds each. Contact of the two rail ends creates a short circuit that induces resistance heating, and the complete pre-heating cycle brings the rail ends to a plastic molten stage, at which point upset forging takes place. Thirty tons of pressure squeeze the rail end together for about 10 sec followed by an instantaneous blow of 50 tons that removes any foreign matter and surplus molten metal from the weld joint, totaling about ⅜-in. from each rail end.

Because of the small depth of heat penetration, the bulge caused by ramming the two molten rail ends together leaves a relatively small "flash" of surplus metal around the weld joint. While still red-hot, this burr is trimmed to a fraction of an inch by the automatic shear block immediately after welding.

The completed weld area is then ground down to the desired rail finish. The grinder that performs this operation is fully adjustable for various sizes of rail and contour rollers can easily be changed for the various rail heads.

NEW ROPE THREAD MAKES UNCOUPLING EASY WITH SANDVIK COROMANT EXTENSION STEELS



Rope-Type Threads Afford No Starting Points for Fractures

Connections used in extension drill-steel must be easy to assemble and uncouple, and connections must not become weak links during the actual drilling. Sandvik Coromant's new patented rope thread makes it easy to join and uncouple the equipment . . . yet gives a solid and positive connection. The gently rounded form of this thread means trouble-free performance—eliminates common thread and coupling failures found in "saw-tooth" threads. The complete equipment—bit, rod, coupling sleeve and shank adapter—are all dependable Sandvik Coromant parts made of world-renowned Sandvik alloy steel. A further advantage to the user is that the steel can be re-threaded. Atlas Copco has special literature on Sandvik Coromant extension steel and long-hole drilling, available to you with no obligation. We suggest you write today!

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What's New in U.S. Patents

OLIVER S. NORTH

Mining

An improved rock drill bit having spaced parallel V-shaped cutting edges which extend continuously across the bit face. Latter is concave, so that the load on the cutting edges is taken at points spaced outwardly from the center. L. Bredesen. No. 2,863,639.

Metal and Mineral Processing

Apparatus for cooling sintered ores consists of an endless movable series of trays perforated to allow for admission of air. J. W. Meredith and A. T. Rogers, assigned to Huntington Heberlein & Co., Ltd. No. 2,862,308.

Agglomerating hematite or magnetite concentrates. Pellets are formed and updraft fired on a moving bed. Additional layers of green pellets larger than those of the initial bed then are layed onto the indurated balls, and the firing continued. Ultimate bed depth after successive additions may be up to ten times that of the initial green ball layer. L. J. Erck and D. C. Violetta, assigned to Cleveland-Cliffs Iron Co. No. 2,862,807.

Reducing porous iron oxide ore pellets. Pellets are passed downwardly through a shaft furnace countercurrently, first, to a hydrogen-nitrogen gas at elevated temperature and pressure and, secondly, to a rising zone of cold hydrogen-nitrogen gas, whereby the cold gas is heated. Pellets are removed, agitated to prevent sticking, and cooled, after which they may be stored indefinitely without undergoing any appreciable reoxidation. F. W. de Jahn, one-half assigned to Alan N. Mann. No. 2,862,808.

Method for H_2SO_4 leaching of pitchblende or other uranium ores. Pulp is aerated in the presence of a soluble iron or manganese compound, the pH adjusted to about 1.25, and metallic iron powder added to precipitate the uranium. A. Thunaes, F. T. Rabbitts, K. D. Hester and H. W. Smith, assigned to U.S. AEC. No 2,863,716

Uranium values are recovered from a copper-bearing solution by absorbing the copper and uranium salts onto an anion-exchange resin and then eluting the copper salt with an alkali metal cyanide and the uranium salt with an alkali metal carbonate. Process is especially applicable to the processing of torbernite, gilpinite, zeunerite, metazeunerite, and johannite. R. Kunin, assigned to U.S. AEC. No. 2,863,717.

Process for recovering selenium values from selenium-bearing slimes, sludges, anode muds, etc. Obtained from electrolysis of some copper ores. Slag is formed by fusion of the material with Na_2CO_3 or NaOH, and the slag first oxidized and then reduced to convert the contained selenium to the alkali metal selenite state. Values are recovered by leaching the slag. C. B. Porter, A. L. Labbe, Jr., and K. N. Pike, assigned to American Smelting & Refining Co. No. 2,863,731.

Preparing briquettes of oxide zinc ore concentrates. Green briquettes consisting of ground ore, bituminous coking coal, and kaolin or fire clay are coked. Coked briquettes of this composition have higher strength than those formed using bentonite or other montmorillonitic clay as the binder. Very few fines are formed during retort smelting of these briquettes. R. G. Crane and O. J. Cerna, assigned to American Smelting & Refining Co. No. 2,863,758.

In the electrolytic winning of zinc from zinc sulphate solutions using insoluble lead anodes, the anodes are pre-coated with manganese dioxide. Zinc produced on such coated anodes is of high grade with respect to lead content. Lead content fluctuations are reduced or eliminated. J. J. Henderson and H. L. Montague, assigned to American Smelting & Refining Co. No. 2,863,810.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Design for a high-capacity but relatively simple dry concentrator for use in the working of gold placer ground. A bellows is operated in association with a tilted belt of porous belting. Lightweight material is continuously stratified on top of the heavy material. Waste works down and off the lower end of the belt, while the values are retained thereon and discharged over its upper end. G. T. Bolander. No. 2,864,501.

Anion exchange process for the recovery of uranium and vanadium from carbonate solutions obtained from the Na_2CO_3 leaching of air-roasted carnotite ore. R. H. Bailes, D. A. Ellis and R. S. Long, assigned to U.S. AEC. No. 2,864,667.

Treating hematite or magnetite fines to produce a synthetic ore product suitable for use in steelmaking. Fines are continuously reduced to FeO in a fluidized bed, and then the FeO partially reduced to the metallic state. Thereafter, the mixture of FeO and metallic iron is agglomerated without reoxidation. J. C. Agarwal, assigned to U.S. Steel Corp. No. 2,864,686.

Forming iron ore pellets preliminary to fritting. Mixture of anthracite fines or coke breeze and pieces of ore of widely varying sizes, ¾-in. down to a large portion of minus 100 mesh, is wet pelletized to produce accretions of ore fines around the relatively large ore particles. Pellets have high green strength and can be sintered without the necessity of including sinter return in the feed. T. L. Myron, assigned to U.S. Steel Corp. No. 2,864,687.

In the removal of oxygen from hematite ore, minus ⅜-in. ore particles are treated in a fluidized bed in a two-stage reactor system. T. F. Reed, assigned to U.S. Steel Corp. No. 2,864,688.

In the recovery of cobalt from calcined pyrites, the pyrite cinders are digested in H_2SO_4 under autoclaving conditions, whereby the non-ferrous metals present are solubilized. Metals may then be selectively separated by controlling the pH of the leach solution, the final solution containing the bulk of the cobalt. E. B. Mancke and F. M. Temmel, assigned to Bethlehem Steel Co. No. 2,864,692.

As a means of dewatering ore concentrates to provide a friable and easily handled filter cake, a small amount of a polyoxyethylene derivative is admixed with the aqueous ore slurry. One derivative said to be especially useful is "Tween 81," produced by Atlas Powder Co. E. G. Stoneman and G. A. Frame, assigned to International Nickel Co., Inc. No. 2,864,765.

Recovery of germanium sulphide from sulphide ore concentrates. Ore is mixed with a relatively small amount of coal, and the mixture fired at 800 to 1150 deg C. to volatilize the germanium sulphide. L. J. Bechaud, Jr., and P. Malozemoff, assigned to Tsumeb Corp., Ltd. No. 2,865,712.

Blast-furnace grade iron ore briquettes possessing high green strength are made by mixing hematite flotation concentrates with thick aqueous paper pulp prior to the briquetting operation. J. H. Crowe, assigned to Minerals & Chemicals Corp. of America. No. 2,865,731.

Process for sponge iron from lump ore, pellets, or other form of agglomerated iron ore concentrate. O. Jensen, assigned to Norsk Hydro-Elektrisk Kvaelstofaktieselskab. No. 2,865,732.

In this two-stage process for smelting ores, particularly ferrous ores, the first and second fuel supplies are independent of each other and can be separately regulated depending on the exact fuel demands of each stage. For example, pyrites may be melted in an oxidizing atmosphere and the SO_2 recovered, and then the molten metal fired in a reducing atmosphere to recover metallic iron. A. Carli, assigned to Societa Finanziaria Siderurgica Finsider S.p.A. No. 2,865,733.

Process for making steel from iron ore, recovery of iron or other metals from pyrites residue, etc. Metal-bearing material is first continuously reduced and then the oxygen potential adjusted so as to produce a metal of the desired composition by a single reaction. Thus, steel may be made directly from iron ore without passing through a pig iron stage. S. Klemantaski, assigned to The British Iron & Steel Research Association. No. 2,865,734.

Mr. North is patent consultant, Washington, D.C.

THE BIG E ... SURPASSES EXPECTATIONS!

THE CASE OF THE DISAPPOINTED SALESMAN

Fred's a good salesman. Enthusiastic. Convinced of the proven superiority of the Eimco 105 Overhead Loader. But there are times when even a top salesman can't fight it. That was the case with Fred, when he wrote the following report to the home office:

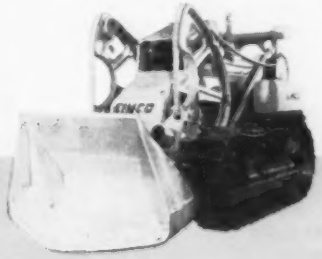
"I have for many months been looking forward to getting another order for an Eimco 105 here*, but THIS ONE (Eimco 105 Overhead Loader) IS SO FAR AHEAD OF THEIR EXPECTATIONS AND THEIR PRODUCTION WITH THIS MACHINE IS SO NICELY HANDLED, THAT I DOUBT IF THERE WILL BE ANOTHER ORDER FORTHCOMING FOR QUITE A LONG WHILE."

"THEIR COSTS IN THIS MINING OPERATION ARE SO FAR BELOW THEIR CONSULTING ENGINEER'S ESTIMATES AND THEIR PRODUCTION HAS BEEN SO MUCH HIGHER THAN THEY EXPECTED, THAT THEY HAVE CURTAILED PLANS FOR EXPANDING THE DEVELOPMENT OF THIS PROPERTY."

What's a salesman to do? Fred had the answer. Make sure that other mining operators also learn about the savings potential, high production of the Eimco 105 Overhead Loader Crawler-Tractor. Fred, or one of his associates . . . the sales-engineers of The Eimco Corporation . . . will be glad to demonstrate the multiple advantages of the modern tractor . . . the rugged, reliable, maneuverable Eimco 105.

*—Original letter and name of mining company on file.

Just contact the sales office nearest you or The Eimco Corporation, P.O. Box 300 Salt Lake City 10, Utah, U.S.A. Tell 'em Fred suggested it!



B-379

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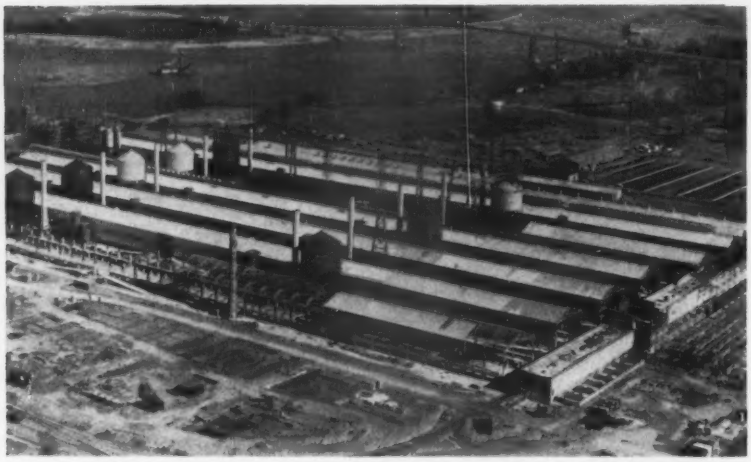
SALT LAKE CITY, UTAH
EXPORT OFFICE, 51-52 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD



YEAR-END was a benchmark for Reynolds Metals Co.'s $88-million aluminum reduction plant, which was 70% completed at that time. The plant is located on the St. Lawrence Seaway complex and will take advantage of the power potential developed by the project. Bridge in the background connects the U.S. and Canada.

Superior Oil Discovers Potash Beds in Utah

SUPERIOR OIL CO. of California has discovered potash in prospect of the southwest portion of the Big Lisbon Fault area of northern San Juan County, Utah.

The discovery is about 35 miles southeast of the Cane Creek developments of the Delhi-Taylor Oil Corp. in Grand County.

A number of other evaporite beds, similar to those around Cane Creek, SW Lisbon Fault and Seven Mile Anticline (northwest of Moab in Grand County) also have been delineated by geologists in surface work.

Drilling has not proved up these other beds. However, some geologists are excited over possibility of very tremendous deposits of potash in this part of Utah's Paradox Basin.

Depth would, of course, be a controlling factor.

The potash at Cane Creek is around 2,000 ft, according to some observers. The grade is very high. Depth is reported at nearly 1,000 ft shallower than deposits in Saskatchewan. It is reported that the Canadian beds will require greater beneficiation than the deposit at Cane Creek —the area farthest along in drilling development and proved reserves in the Lisbon Fault region. Delhi-Taylor is expected to disclose progress of recent work in some 60 days.

Delhi-Taylor has made no recent announcement as to financing or marketing potash from its Cane Creek find. However, it has been reported that investment of around $20-million would be needed to equip shaft, mine, and beneficiation plant and provide for haulage of product to nearest rail head.

Meanwhile, Superior Oil Co., operating with exploration crew out of Grand Junction, Colo., has secured rights on 10,000 acres of prospect permits from the Federal Government. The firm also is continuing to acquire other potash prospect permits in the area.

Superior Oil has completed one core hole to about 3600 ft on a state school section in Township 30 South and Range 25 East and has delineated a potash bed at around 3400 ft.

The firm also reportedly picked up stringers or evidence of another potash bed at about 2400 ft. Superior already has started another core test on a Federal potash permit (2,560 acres) in Section 17, Township 30 South and Range 25 East.

This Federal prospect permit also is in the process of being converted to a potash "lease." Under terms of a lease, the company agrees by terms of the lease to proceed with economic development of the potash. The fact that Superior already has started proceedings to convert the permit to a lease—while the drill hole is still not completed—indicates that it found sufficient evidence of bed-thickening in the hole one mile north.

Superior, of course, would make no development move until additional validation is completed. At present, the record of its first hole is sealed—but should be released within next few months by the Utah Oil & Gas Conservation Commission.

Under rules of prospect permit grant, Superior will have to drill a validation hole for each 2,560 acres under permit.

This means the company has two or three more holes to drill in the area.

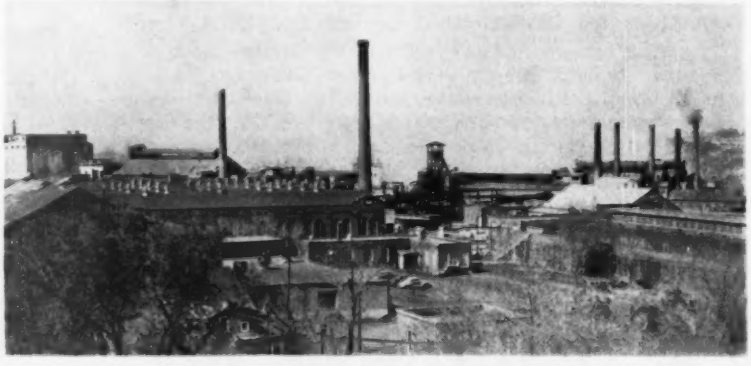
Survey of Minerals in Swaziland Is Under Way

BRITISH GOVERNMENT and the South African mining houses are prospecting to complete their picture of the mineral wealth of Swaziland. A great deal of research has been done in recent years by the Department of Geological Survey in the territory.

Iron ore—As a result of prospecting on the Bomvu Ridge, about 10 miles north-west of Mbabane, the administrative capital, a large hematite deposit has been charted. The site is Crown Mineral Area No. 7. The strike length is 3,700 ft and the width varies from 400 ft to 180 ft. The boreholes go down to a maximum depth of 500 ft and results show an estimated 31,736,000 short tons of high grade ore. Anglo American has been doing exploratory work on the site for about six months and its results are so far confidential.

Expert opinion is that the deposit goes down to a minimum 1,000 ft, however, which might give reserves in excess of 60-million tons. The geological survey re-

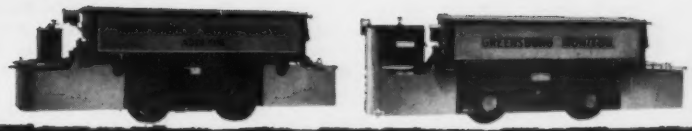
(Continued)



100 YEARS OF ZINC EXTRACTION was noted in December by Mattheissen & Hegeler Zinc Co., La Salle, Ill. Ground was broken for the La Salle plant (above) in December 1858 by Frederick W. Mattheissen and Edward C. Hegeler, who met as schoolmates at the School of Mines, Freiberg, Saxony. In 1881, the company built the world's first sulphuric acid plant using zinc roaster gas, oxidizing the sulphur to sulphur trioxide and absorbing it in water to form the acid.

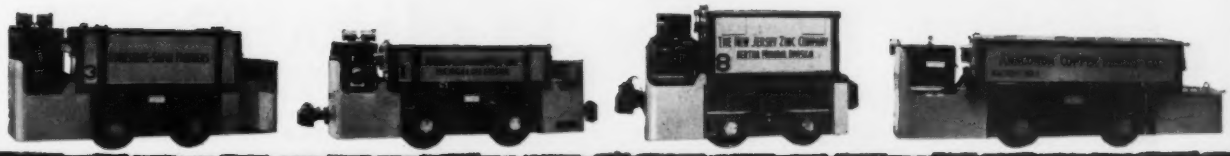
National Mine Service Company

GREENSBURG MINE LOCOMOTIVES



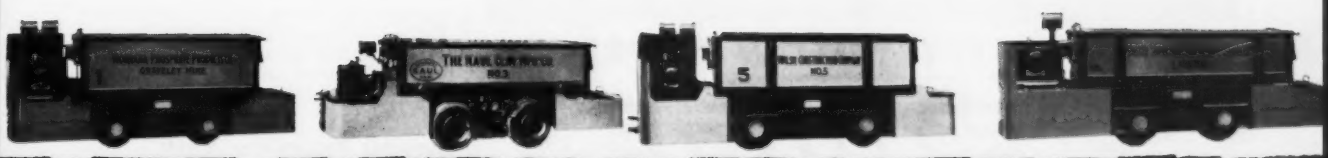
SERVING THE MINING INDUSTRY EVERYWHERE—

THE GREENSBURG DIVISION

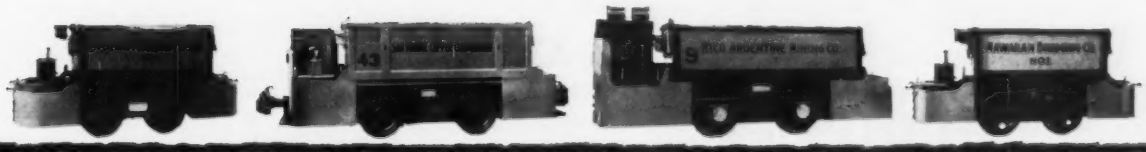


MANUFACTURING, SELLING AND SERVICING

THE FAMOUS GREENSBURG LOCOMOTIVES



GREENSBURG MONITOR—a great name in mine locomotives—is now an integral division of NATIONAL MINE. The complete range of Greensburg Monitor Storage Battery Locomotives, from 2 to 15 tons, is backed by the service of National Mine in every major mining area. When you want *more pulling power per ton*, with longer battery life and higher efficiency for every invested dollar, check the facts with National Mine!



National Mine Service Company

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Swaziland *(Continued)*

port states that the minimum depth so far established is 620 ft.

The biggest visible barrier to establishing mining operations in this field is the lack of transport. The site is about 150 miles by road from the nearest seaport—Lourenco Marques. It is 50 miles from the nearest railhead at Lothair (E. Transvaal). There is some hope of the railway line being extended into Swaziland as a result of discussions being held by the British authorities and the South African Railways.

The geological report says considerable horizons of banded ironstone occur in several areas of Swaziland but the quality of these reserves is very low as compared with the Bomvu deposit, having a content estimated at between 25% and 35%. This excludes them as an economic proposition under prevailing conditions in the territory.

Gold was worked for many years in Swaziland but the last mine of any size closed about five years back.

Asbestos—The large occurrence being worked at Havelock near the Transvaal border is the only one known in the country.

Tin—A certain amount of tin being worked in a small way, by alluvial methods. No large tin body yet discovered.

Barytes—A deposit of barytes is being worked in a small way near the Bomvu Ridge.

The major mining houses interested in Swaziland at present are: Anglo American Corp.—prospecting at Bomvu Ridge through a subsidiary company; Johannesburg Consolidated Investments, who have been interested in iron ore in the territory for several years; and Rand Mines Ltd.—who seem to be interested almost exclusively in the coal deposits in the territory.

Alcoa Starts Pt. Comfort, Begins at Brokopondo

FIRST SHIPMENTS of bauxite from Cabo Rojo, Dominican Republic to Aluminum Company of America's Point Comfort, Tex. alumina plant took place in January.

The 7,300-ton shipload in January, and another this month, were in the nature of pilot operations. Formal dedication, and regular shipments were expected to begin this month. The Dominican Republic operation represents an investment of $14-million.

In Surinam, engineering surveys have begun on the $150-million Brokopondo hydroelectric project, which will be a dam, a 150,000 kw powerhouse and a transmission line. A new Alcoa smelter with 60,000 tons annual capacity will be built to consume some of the electric output. Target for completion of the power project is 1965.

Vale do Rio Doce Plans $12.5-million Expansion

AN EXPORT-IMPORT BANK LOAN of $12.5-million was made to Vale do Rio Doce for expansion of its iron ore property in Brazil. The money will go principally for purchase of shovels, loaders, tractors, crushing machinery, etc., it is reported. Part of the funds will also be used to develop port and railroad facilities. Output will be increased to 6-million tons per year.

Grand Junction Staff Moves Toward New Role

WHAT WILL HAPPEN to the domestic materials procurement staff of the Atomic Energy Commission after its 1962-1966 program goes into effect?

Officials of the Grand Junction Operations Office of the AEC see themselves largely in a contract enforcement role. Probably, there will be no major decline in number of employes at the Grand Junction center, *E&MJ* was told.

1. Despite some surveys looking for possible changes in procedure and delivery, it is still expected that Grand Junction will continue to be the major receiving point for uranium concentrates from domestic mills. A possible exception: production from as-yet-to-be authorized mill in Duvall County, Tex., which may deliver to AEC in east—as do foreign producers. *(Continued)*

THE BIGGEST NEWS IN MINE VENTILATION TUBING . . .

BEMIS SAFETY YELLOW NYPRENE

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SAFETY YELLOW means just that . . . SAFETY! The yellow Nyprene material reflects light and is readily visible in darkness. It minimizes damage from punctures by machinery and equipment.

Then add these six other major benefits and you'll see why Bemis SAFETY YELLOW Nyprene FLEXIPIPE is your best ventilation value . . .

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Industry Moves Ahead with Plan '59...

To modernize now for growth and profits

The most expensive task to be performed in America, in this new year of 1959, is the modernization of our industrial plant and equipment. This is true despite the huge expenditures on new facilities made in the past decade.

Contrary to popular opinion, and even to much learned opinion, our industrial facilities are not up to date. In a special survey conducted in August 1958, and supplemented by further interviews since that time, the McGraw-Hill Department of Economics found that it would take $95 billion to bring all our plant and equipment up to the best modern standards. This is over $15 billion more than the record budget of the U.S. government for the coming year.

How did we get so far behind? It is true that business has made record capital expenditures in recent years, but most of this investment has been to expand capacity. And in concentrating on new capacity, industry has fallen behind on the modernization of older facilities. Meanwhile, the $8 billion a year surge of research and development has brought forth new machines and new processes, at a rate that makes prewar and even early postwar equipment badly obsolete.

The lag between what research has promised —especially in more efficient tools of production —and what has actually been accomplished up to now shows clearly in the AMERICAN MACHINIST inventory of metalworking equipment for 1958. This new study, covering 167 types of equipment in 5,800 metalworking plants, shows that three out of five metalworking machines are over ten years old. This is a startling indication of how obsolete many plants have become. A 1958 machine tool is 54% more productive than one purchased in 1948. Many of the tools industry now uses are actually of 1939, or earlier, design.

Investment Starts Up

Now industry's plans for 1959 show a new awareness of the need to modernize. In its surveys, conducted during the last part of 1958, the McGraw-Hill Department of Economics discovered these facts:

(1) Companies generally believe that a larger investment in modernization will

mean more profits—soon. Most of the manufacturing companies in the surveys expect their current modernization expenditures to pay off in less than five years. With labor costs rising steadily, it is only with better, more modern equipment that most companies can hope to make these profit gains.

(2) Industry's plans for modernization have been revised upward. Total plans for 1959 investment, in new plant and equipment, now come to $33 billion—compared with $31 billion reported earlier. And most of these new plans are directed toward modernization—installing new processes or making ready for new products, developed out of the most recent scientific advances.

It therefore seems clear that modernization expenditures in 1959 will rise enough to make an impressive start on the job of updating our plant and equipment. But it will be no more than a start. Research also is moving ahead with giant strides. Plant expenditures must increase rapidly, from 1958's low level, to win the battle against obsolescence.

How Can We Modernize Faster?

What can we do to accelerate industry's new drive for more modern plant and equipment? One aid will be an improved flow of technical information on how, and where, to modernize. With this purpose, the McGraw-Hill Publishing Company several months ago inaugurated PLAN '59, a joint effort by all its magazines to spotlight the best opportunities for modernization. During 1959, McGraw-Hill publications will continue this effort by putting special emphasis on new developments in plant and equipment.

On the key problem of financing modernization—the question "Where's the money coming from?"—the McGraw-Hill Department of Economics plans several new studies in the months ahead. The first of these will deal with the number one problem in financing: the need for adequate depreciation allowances. Such studies are a small, but we hope a helpful, part of the total effort that is needed to modernize American industry.

An Individual Effort

The really vital steps in modernizing must be taken by individual companies. The backlog of obsolete plant and equipment is widely dispersed, among firms of all sizes and in all areas. It cannot be wiped out by dynamic equipment policies on the part of a few leading firms. Not just a few, but thousands of industrial companies must take inventory of their respective equipment and compare it, case by case, with the best new machines available.

Finally, there is need for increased public recognition of the modernization problem, and for federal tax policies appropriate to a period of rapid technical change in business.

The most important point is that the modernization drive has begun. This start can accelerate, with intelligent business and public policies, to give us truly modern industrial facilities. Plant and equipment expenditures are finally beginning to reflect the stepped-up pace of research and development. This can be a major factor in renewed economic growth and prosperity as we move into 1959.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

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PRESIDENT
McGRAW-HILL PUBLISHING COMPANY, INC.

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GJOO Staff *(Continued)*

2. Ore reserves established to Nov. 24, 1958, must be "policed" to be sure that custom shippers are protected. This might entail more policing than is presently the case under the Circular Five program, said a spokesman.

3. Uranium concentrates contracts also will be policed in mills, insuring custom shippers of their rights under the program. These rights are based on the type of contract terms under which the AEC agrees to buy so many total pounds of uranium oxide to be delivered in stated amounts on annual period over life of the contract.

4. Contract administration will provide insurance that where possible the reserves of independent producers will be accommodated in existing mills. This covers those miners, particularly in Uravan Mineral Belt, whose reserves currently do not exceed 60 days present mining rate. Their place in any 1962-1966 program will have to be determined administratively, with possible frequent review over the years, by the Grand Junction Operations Office.

Presumably, the present "mining department" of the Grand Junction Operations Office would have this job.

Uranium Find Announced By Mexican Commission

MEXICO'S NATIONAL NUCLEAR ENERGY COMMISSION announced this week that it had discovered reserves of more than 8,000 tons of radioactive materials and indications of other "much larger" reserves in other parts of the country. All this was done in less than two years, a commission spokesman said.

IN THE U.S.

ALASKA

Mineral production for 1958 dropped an estimated $8,809,000, or nearly 30%, from that of 1957. The decline was caused chiefly by the lack of uranium production and the drop in coal, stone, and sand and gravel production. Also responsible was the lack of chrome production, the decline in mercury production, and the decline in price for nearly everything except gold.

USSR&M Co., Alaska's largest producer, has announced publicly that its major operations at Fairbanks and Nome will not continue beyond 1963 or 1964 under the present economic conditions.

The chief hope of increased mineral production in Alaska (in addition to oil,) is presently pinned to her copper, nickel, iron, and coal resources. Of the iron and coal, the possibilities of early development of new operations are contingent on the Japanese export market. However, if and when nuclear reactors for power

Alaska *(Continued)*

OPEN PIT MINING SPECIALISTS, the Isbell firm relies exclusively on Texaco lubricants to keep 17 large dump trucks, 4 shovels, 2 'dozers and 2 rotary drills on the job.

"This truck has run over 7500 hours —and we've never removed the pan"

"The Texaco Simplified Lubrication Plan keeps maintenance costs down, keeps the job on schedule," reports George L. Laughton, Supt. of Isbell Construction Company's Three Kids Mine project.

Isbell Construction Company is doing strip mining on contract with Manganese, Inc., Henderson, Nevada. They are using a Texaco Simplified Lubrication Plan for this project, and it is piling up some outstanding records.

"As of January 17, the truck shown in the picture had operated 7,714 hours using *Texaco Ursa Heavy Duty SAE 40* exclusively, and it's never had the pan removed," reports Superintendent George L. Laughton. "We also use *Texaco Crater 2X Fluid* for wire rope, *Texaco Gear Lube HD* for transmissions, *Texaco Marfak* and *Texaco Marfak Heavy Duty,* for chassis and wheel bearings. We are entirely satisfied with Texaco lubricants," says Mr. Laughton, "and we have never had a failure due to lubrication."

For *your* equipment, Isbell's outstanding success with Texaco lubricants proves two things: the quality of Texaco lubricants, and the advisability of getting Texaco to work out *your* Simplified Lubrication Plan. Because it is tailored specifically to each job's special needs, a Texaco Simplified Lubrication Plan enables you to handle all major lubrication with very few lubricants—as few as 6 in many cases. That keeps lubricant inventories low, and cuts down your chances of making lubrication mistakes. It also trims your maintenance expense. Above all, your equipment runs smoothly so your jobs can keep on schedule.

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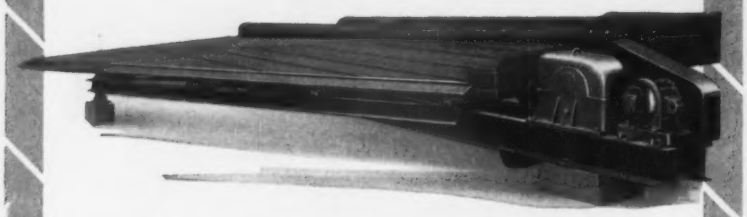

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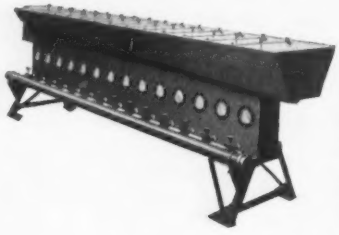

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Alaska *(Continued)*

are installed in Alaska, her present coal production will be depleted drastically. Copper and nickel production will develop according to the price, demand, and incentives, which are insufficient at present.

Mineral Production[1]
(Short tons)

	1958 preliminary	1957
Antimony		17
Chromite		4,207
Gold (troy oz)	215,000	215,467
Lead	1	9
Mercury (flasks)	3,200	5,461
Platinum (troy oz)	(2)	(2)
Silver (troy oz)	28,000	28,862
Uranium	(2)	(2)

(1) Territory of Alaska Dept. of Mines and USBM.
(2) Undisclosed.

IDAHO

The Albany, Ore., regional office of the Bureau of Mines reports that Idaho's 1958 mineral production was valued at $62.8-million, lowest since 1946 and a decline of 15%, $10.7-million, from the 1957 valuation of $72.4-million. Depressed lead and zinc markets were principally to blame for the reduction. Moderate increases in cement, cobalt, copper, phosphate rock and silver partially offset the reduction. The production figures: (short tons)

	1958	1957
Antimony (ore and conc)	700	664
Copper	9,600	7,912
Gold (troy oz)	14,700	12,301
Lead	52,400	71,637
Mercury (76-lb flasks)	2,800	2,260
Phosphatic rock (long tons)	1,379,700	1,306,742
Silver (fine oz)	15,565,000	15,067,420
Titanium conc. (gross wt)	2,000	28,397
Zinc	46,900	57,831

CALIFORNIA

Sunray Mid-Continent Oil Co. has launched an intensive search for "solid minerals" in the Mojave Desert. A six-man exploratory crew is conducting core drilling operations on a 75,000-acre expanse of the comparatively unexplored plateau. The crew started geophysical and core drilling activities in May and was to continue working through February.

F. W. Borden, vice president of California operations for Sunray Mid-Continent, said the company is searching for common minerals which exist in commercial quantities and for rare minerals which may have potential.

Sunray geologists believe that additional commercial deposits of evaporites and salines will be found in the desert.

Prime Contractor: Merritt-Chapman & Scott Corp.

DRILL STEEL BORES BOLT HOLES AT GLEN CANYON DAM—One of the world's highest dams, Glen Canyon, is now under construction on the Colorado River in Arizona, a mere 12 miles from Utah's southern boundary. It is being built for the U. S. Bureau of Reclamation to provide a storage basin 186 miles long, and to furnish power to a five-state area. Upon completion, the dam, 1500 ft across its crest, will rise 580 ft above the river, and join the sheer 700-ft-high canyon walls. In the photograph above, Bethlehem Hollow drill steel is boring holes in the tough sandstone face of the canyon. Bethlehem anchor bolts, in 6 ft and 8 ft lengths, were later inserted in the holes to prevent the rock from spalling.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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BETHLEHEM STEEL

BETHLEHEM STEEL

This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and The Cleveland-Cliffs Iron Company.

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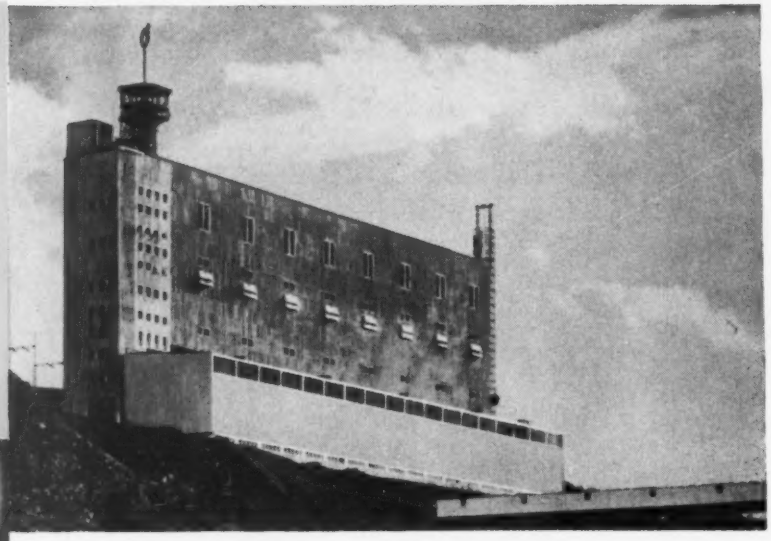

FULLY AUTOMATIC, the ASEA Hoists at Kiruna eliminate the employment of hoist men. At U.S. wage rates, assuming two-shift operation, this would mean a saving of about $30,000 yearly for each hoist!

Write for illustrated literature on ASEA Multi-Rope Friction-Drive Mine Hoists.

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California *(Continued)*

Borden said such minerals might include beryllium, kyanite, lithia minerals, special types of clays, bastnaesite, monazite, and zenotine.

Saline minerals might include trona, hanksite, potassium chloride and borax.

For determining test sites, Sunray has used surface geology, photo-geology, geophysics (mostly gravity meter surveys), and previous core holes and wells (which are few).

Core tests are made from a specially adapted shot-hole rig. Other field equipment includes a laboratory trailer, crew trailer and water truck.

The laboratory is equipped with a complete wet chemical analysis setup which permits chemical determination of minerals. A petrographic microscope, oil immersion equipment and geiger counter are included.

Directing the field operation is R. G. Maynard, Sunray regional geologist and former UCLA instructor of petrography. The crew maneuvers in the desert on a military-like basis and lives in the desolate region four days a week on a 10-hour-a-day shift.

Members of the party include T. J. Griffith, drilling foreman; Jack Leach, geologist; Ray Cantrell, well puller from Fillmore; Bob Chadwick, well puller from Taft; and Jay Stevens, roustabout from Newhall.

The domestic mercury industry faces liquidation within the next 90-120 days unless some form of Government assistance is immediately forthcoming, according to the American Quicksilver Institute.

S. H. Williston, Palo Alto, reported that: the Buena Vista mine in Southern California already has closed down; Samuel S. Arentz of Salt Lake City has proposed temporary closure of the Bretz mine in the Nevada-Oregon mercury area; Rare Metals Corporation of America said it doubts it can continue production at today's prices past next four months at the Weiser, Idaho open cut mine and process plant.

Williston said his Cordero Mining Co. in northwestern Nevada, largest producer in the nation, would not reopen if it had to close. Constant attention to bad ground in the underground property is required, he explained.

Williston said, following an Institute meeting at Palo Alto, that prices now were as low as $212 per 76 lb flask. He charged the Government had not fully implemented its domestic purchase program which ran out Dec. 31, 1958, anyway.

Institute members discussed these following possible remedies:

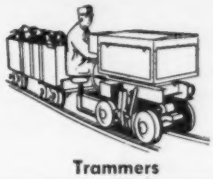
1. A Congressional investigation of Administration actions involving quicksilver:

2. Appeal to the Senate Finance Committee for legislation increasing import tariffs.

3. Appeal to the Treasury Department for action (quotas) to end "dumping by one foreign nation."

Yuba Mining Division of Yuba Consolidated Industries, Inc, has leased the

NEW EXIDE-IRONCLAD LOCOMOTIVE BATTERIES PACK UP TO 45% MORE POWER

APPLICATION	NEW TYPE BATTERY	CAPACITY PER POS. PLATE	REPLACES BATTERY TYPE	PERCENT CAPACITY INCREASE
 Trammers	MG	45 ah	MVM ML	32.4 17.5
Mine locomotives	RG	55 ah	ML TLM	43.6 5.0
Shuttle cars	TG	72 ah	TLM TH	44.0 20.0
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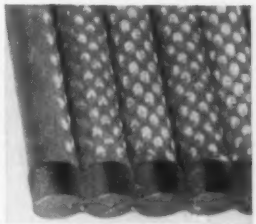

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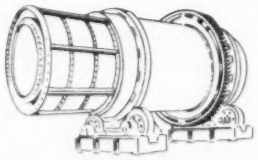

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California *(Continued)*

Royal-Mountain King gold properties, which are located on the Mother Lode 2 miles north of Copperopolis in Calaveras County.

Yuba recently awarded a contract to Joy Manufacturing Co. to conduct a diamond drilling program on the two adjoining properties. Three drilling rigs are now in operation on a two-shift basis.

Karl Mesterton, Yuba exploration engineer, is in charge of the operation.

Yuba obtained a lease, with option to buy, from Charles W. Stewart and associates, of Fresno division.

One aim of the drilling program is to determine whether it would be practical to extract the ore by open pit method. Last worked in the 1930's, the properties were mined by underground method.

The gold occurs in semi-disseminated deposits in sulphides. Drilling has not advanced far enough to give a reliable picture of grade of the ore.

COLORADO

If tungsten prices continue to ascend during 1959 as they did in last quarter of 1958, some western properties might be re-opened.

R. G. Sullivan, Grand Junction, Colo., president of Minerals Engineering Co., notes approximately a 50% advance in prices of tungsten since their low of last 1½ years.

He estimates that the severity of the adjustment of U.S. mines to the overproduction of tungsten in the world is running its course. And he anticipates that if stocks of tungsten continue to be eaten away at present rate, then his firm can resume mining and concentrating of tungsten in Montana and refining of the metal at a refinery in Salt Lake City.

All of the firm's tungsten operations have been shut down since forepart of 1958.

The mining picture brightened at Cripple Creek with some of the mines in production. "In fact," said C. H. Carlton, general manager of the Carlton properties, "production in the camp is somewhat above normal."

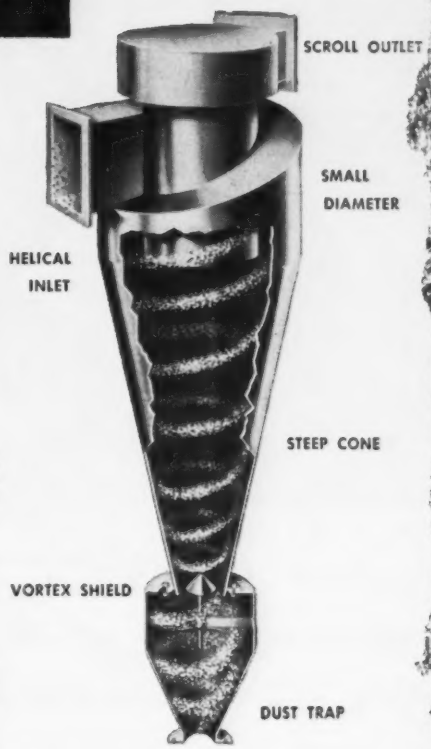
Carlton attributed the increased production to a higher average value ore than usual and the increased quantity of ore of some newcomers who are reopening some of the abandoned mining properties in the District.

Usually, production in the camp averages about 10,000 tons of ore per month, including that shipped from dumps. The Golden Cycle mill shipped three gold bricks to the Denver Mint recently worth $77,000.

Olson and Nolan, leasing on the 3100-level of the Ajax mine of Golden Cycle shipped two more cars of high grade from the winze they are working. One car settled for 6.04 oz of gold to the ton, the other 3.67 oz.

Cameron mine has increased production and has two shifts working. Ore is of good grade, the last carload having settled at 1.19 oz gold per ton. In addi-

. . . in dry dust control



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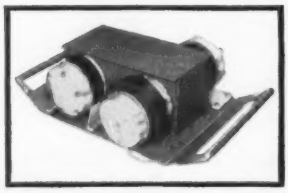
PLM Cable Couplers simplify joining lengths of portable cable together or to electric shovels or portable substations. Each coupler consists of connecting plug and socket, fully insulated and ruggedly protected and weatherproofed against electrical or mechanical damage. Optional locking and grounding features meet complete range of requirements. Rating, 300 amperes, 7500 volts, grounded neutral. Write today for descriptive bulletin 375. PLM Products, Inc., 3183 West 150th Street, Cleveland 11, Ohio. CABLE FITTINGS · TERMINATORS · SPLICING KITS



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CABLE PLM COUPLERS

Colorado *(Continued)*

tion, they recently shipped 1,700 lb of high grade to the mill that is expected to settle at about 17 oz gold per ton.

Work on the properties cut by the Lucania tunnel in Clear Creek county is progressing rapidly. The shaft on the Hot Pot is down to the third level and will continue until the main tunnel is reached. The tunnel cuts some of the richest veins in the district. When completed, the Fall River Power & Development Co. the operator, will have one of the largest mining properties in the state, furnishing employment for a number of men.

At Silverton, the Pride mill is back in operation after a brief shutdown. Development work at the Pride mine is now underway. Ore from the mine carries lead, silver, gold, copper and some zinc. A recent additional raise of one-half cent in zinc has given new hope to mines of this area, where zinc is unavoidable in the process of mining for other ores, principally lead, silver and copper.

The rich Gunnison mineral region of Colorado is excited over a new uranium discovery. Pinnacle Exploration, Inc. reports it has begun a development program to remove high grade uranium ore from the Marshall Pass mining district, 43 miles east of Gunnison. James E. Dunn is manager of the company.

Work at the Pitch Mine, named for the rich pitchblende ore deep in the mountainside, was started three months ago. A half mile of road, twisting to the 10,295 ft elevation several miles west of Monarch Pass, has just been opened to the mine entrance, connecting the site with an older haulage road that winds four miles east to Pinnacle Exploration's Little Indian 36 Mine, a site of a uranium operation opened in 1956.

Mine crews have drilled some 50 ft into the mountainside at the Pitch Mine recently. The tunnel will crosscut 800 ft into the hill before reaching the orebody, then a drift will be run 1500 ft south along the length of the deposit.

Utex Exploration Co. of Moab, Utah, is reported unwatering the Cash gold mine at Gold Hill near Boulder, and plans development. Russell McClelland is the geologist.

An overflow crowd of men interested in mining attended the annual Jackson dinner at Idaho Springs put on by the Clear Creek Metal Mining Assn. The Jackson fortune seekers discovered gold there 100 years ago.

The address of the evening was given by Alfred Hoyl of the Contract Engineering Co. It is through Hoyle and his Canadian associates that rehabilitation work is being carried on at the Big Five mine just west of Idaho Springs. He described in detail each phase of the work from the drilling of the 1658-ft air shaft, the installing of the combined hoisting and communication cable, the enlarging of the 11-in. air shaft to a working raise from the lower tunnel-level up, by hoisting a working cage against the "back" using the above mentioned cable attached

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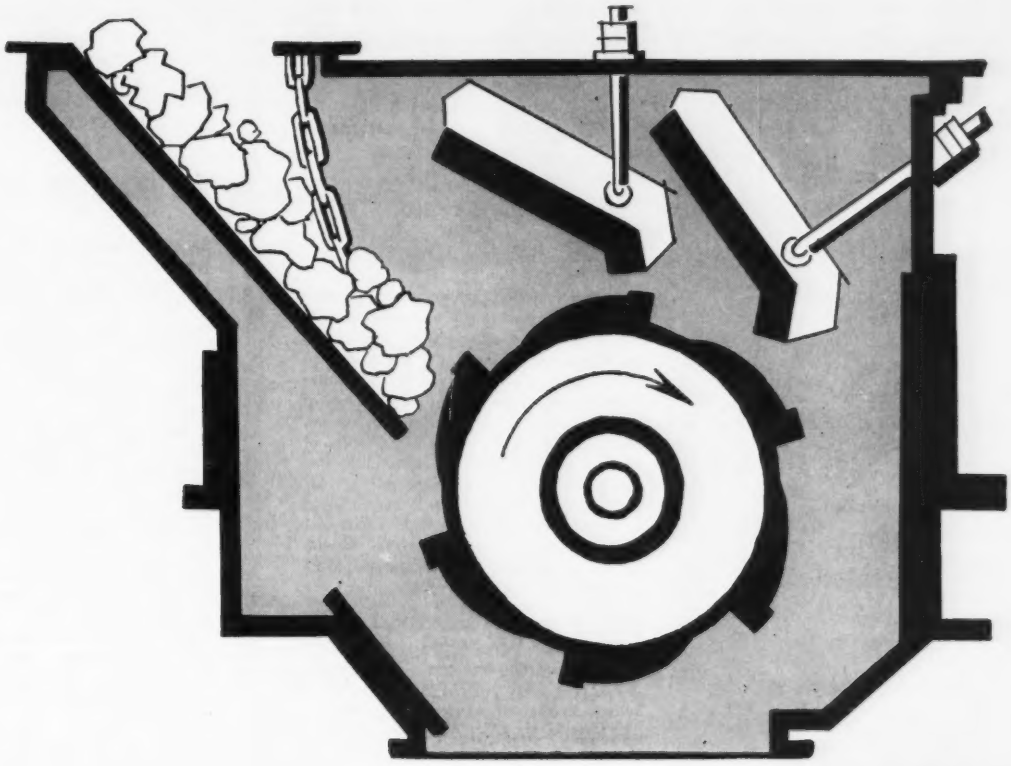
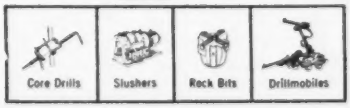


EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.
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THE ONLY VALVE THAT OUTLASTS METAL

11 to 1 in Abrasive Service

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PROGRESS THROUGH HONEST PURPOSE

FLEX VALVE

- Non-clogging
- Corrosion-resistant
- Full pipe capacity
- Absorbs vibration
- Low replacement costs
- No freeze-up in outdoor service
- No obstructions, pockets or internal parts
- Tight on grits to 1/8"
- Maintenance free

More than six years of service carrying abrasive materials that had ruined iron gate valves in four weeks — and still no signs of wear! That's the kind of record FLEX VALVE has chalked up in mining operations. FLEX VALVE's tough valve body materials have resisted the onslaught of steel shot, stone, coal ore, mine tailings, cement, other valve-destroying matter for thousands of hours of trouble-free service. Here is the simplest valve made . . . An integral part of your piping with no internal parts to stick or wear, no diaphragms or packing to leak. The original pinch-type valve — built by Farris for the mining industry's toughest service. In manual or motor-operated types.

FREE TWO VALUABLE BOOKS ON FLEX VALVES

Detailed engineering data, plus special sizing charts are in FL-1116R Flex Valve catalog; Bulletin FL-935 lists several hundred typical uses. Both books yours for the asking.

GUARANTEED NOT TO PLUG OR YOUR MONEY BACK!

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Over 25 Years in Industry's Toughest Service

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Colorado *(Continued)*

to a hoist located on the mountain top.

La Salle Mining Co. has reportedly discovered uranium ore near Jamestown, in Boulder County. Surface diamond-drilling is contracted to Boyle Bros. Drilling Company of Salt Lake City, Utah. La Salle has staked 30 claims around the discovery. Cliff Doyle is superintendent of the company's operations. The firm is also currently operating two other Colorado uranium properties.

Bear Creek Mining Co. has been staking copper claims near Wickenburg, Ariz., and in the La Plata Mountains near La Plata, Colo. In Arizona 200 claims were located about 14 miles from Morristown on the Castle Hot Springs Road. Company engineers and geologists headed by Ray Robinson of Tucson have made geological surveys and chemical surveys. Several types of geophysical surveys are being made to correlate geological findings.

The Colorado claim-staking in the California mining district of La Plata county was directed by Ray Gilbert, of Bear Creek's Denver exploration division. More than 600 acres have been staked and geological and geophysical surveys made. While the district is best known for the high grade gold-silver ores mined at the May Day, Gold King, Bessie G and Idaho mines, disseminated bodies of platinum-bearing chalcopyrite have been found.

HAWAII

More exhaustive studies of Hawaii's bauxite deposits are needed, a group of territorial lawmakers were told by Lands Commissioner Frank W. Hustace at a recent briefing session.

Hustace said the U.S. Bureau of Mines and the U.S. Geological Survey, who made preliminary studies this year, think further studies are justified. USGS favors a four-year study, he said, and the Bureau of Mines is anxious to start a year's test work on bauxite samples.

Most of the bauxite deposits are on the island of Kauai.

The lawmakers also heard advice on how to reclaim land in bauxite areas after strip mining has been completed. Richard A. Howard, Harvard University botanist who has been hired by the Territory as an advisor on the question, said private enterprise should be required to revegetate the land. It's easier to reforest, he added, if you know what type of vegetation the land supported before mining. Howard previously served as a consultant to the Jamaican government on rehabilitation of bauxite areas.

The briefing session included a rundown by Dr. Otto Younge, University of Hawaii agronomist, on experiments he is conducting on the use of various crops for revegetation of strip-mined areas. In anticipation of development of the bauxite deposits, the Territory has appropriated $50,000 to the University for the land recovery studies Younge is working on.

Four Michigan Tractor Dozer models are now available . . this 165 hp size, 262 hp, 335 hp, 600 hp.

Rock quarry cuts repair bills 60%

Company records show rubber-tire Michigan Dozer also has reduced cleanup time 50% over track-type machines

"Like many other stone quarries, we sure used to be unhappy about track maintenance," says G. E. McLeer, vice president, Ohio River Stone Co, Prospect, Kentucky. "Rails alone used to cost us hundreds of dollars per year for replacement . . . plus several man-days of labor per change. No more. Our rubber-mounted Model 180 Michigan Tractor Dozer has run a year now. Naturally, no track problems . . . and no tire replacement either. Looks like original treads will last another year easily. Then, we expect to recap . . . and repeat recap. The savings should be at least 60%."

Excellent performance of Michigan Tractor Shovel echoed in Dozer

"Track wear wasn't the only reason we changed over," McLeer continues. "We chose the Michigan *Dozer* because of our excellent experience with our three Model 175A Michigan Tractor *Shovels*. Their all-Clark power trains really stand up. The Dozer's power train does, too. In its year of operation, the dozer has lost maybe 25 working hours—but that's all!

¼ mile move takes 2 minutes

"Production was another of our aims. The Michigan gets around much faster than the crawlers. In emergencies, for instance, we drive it the 20 miles between our two main quarries under its own power. After all, it's got a top speed of 27 mph, with good visibility, good brakes and power steering.

"Moves in any one quarry aren't nearly as long, but they're virtually continuous. Typical ¼-mile trip takes only 2 minutes . . . half to a third of crawler time. And, of course, the saved minutes go into productive work so necessary with increasing production demands.

"Our time studies show the rubber-tired Dozer *moves more material* on almost all jobs too — 50 per cent more when dressing stockpiles than a track-type machine. The reason? The Michigan moves *just as much* with its 10-foot dozer blade *per load*, yet *moves more loads per hour*. Speed advantage is mostly in faster backup, faster shifting. You don't have to stop to change speeds; just move a short-throw lever. No foot-clutching is necessary, ever."

Jack-of-all-jobs

Michigan Model 180 Tractor Dozer is "work-horse" of the main Derby Company quarry. Unit:

1. Takes about ½ hour to clean quarry floor after each shot.
2. Three to four times a day cleans up around two shovels: one on rock, one on stripping. Total work time, about 1½ hours per day.
3. Once a day, cleans spillage from 2 miles of truck roads.
4. Cleans spillage under crushers and aggregate bins.
5. Shapes nine rock stockpiles.
6. Cleans rock and dirt after stripping and before drilling.

Distributor service praised

"If any of our Michigans go down, we call our distributor (Emmett C. Watson Co of Louisville), and his men come right out," says McLeer. "Very seldom do we have to wait for parts and we get good warranty service."

You can get the same fast, low-cost help from *your* Michigan Distributor. Their good service is an important reason for the sale of over 8,000 Michigan rubber-tire units since 1954. Call them soon . . . they're good friends to know.

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road,
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In Canada: Canadian Clark, Ltd.,
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Michigan is a registered trade-mark of

CLARK® EQUIPMENT

BILL'S IN A SIZZLE

an ordinary tire "blew" the job

but BOB'S ON SCHEDULE with

U.S. ROYAL SAFETY 1ST TRUCK TIRES

service-proved against job delays!

Here's a fact proved at strip mines, sandpits, quarries and construction projects by the hundreds. The best way to prevent costly tire delays and keep hauls *on schedule* is to use U. S. Royal Off-Road Tires!

Here's why. First: today's U. S. Royals give you exclusive, advanced features that pay off in extra traction, greater strength and longer wear. Second: these great new tires are backed up with on-the-spot know-your-stuff *service*—including complete and expert *retreading*.

Find out exactly how easily and quickly *you* can cut job delays with these service-proved tires. Call your U. S. Royal Dealer. Or better still —specify "U. S. Royal" on your next new equipment!

U.S. ROYAL CON-TRAK-TOR®—for rugged operations where utmost traction's required

U. S. ROYAL Super FLEETMASTER—for severe service on all your off-the-road trucks

U.S. ROYAL FLEETMASTER®—Dual Purpose, Nylon—top pull and mileage on and off road

U. S. ROYAL NYLON TIRES ARE TOUGHER, STRONGER, SAFER.

US RUBBER **United States Rubber**

Rockefeller Center, New York 20, N. Y.

In Canada: Dominion Rubber Co., Ltd.

IDAHO

An agreement providing for the profit sharing production from the Nabob mine and mutual participation in other projects has been executed by Nabob Silver-Lead Co. and Sidney Mining Co., according to a joint statement released today by H. J. Hull and M. C. Brown, presidents respectively of the two corporations.

A few years ago a new ore-shoot was discovered on the main tunnel level of the Nabob and partly developed by a winze and a drift on the 1450 ft level. However, depressed economic conditions have prevented the exploitation of the orebody. The adjoining Sidney mine has produced more than 1-million tons of zinc-lead-silver ore, being the largest producer in the Pine Creek district and, during recent years, the only one continuing to operate in the district.

Under the terms of the five-year renewable operating agreement Sidney will immediately install necessary equipment, deepen the Nabob shaft to open a new level and place the mine in production. Expenditures will be recovered by Sidney from first operating profits; thereafter profits will be divided 40% to Sidnew and 60% to Nabob. The agreement gives Sidney an easement to operate the Sidney mine or other adjoining properties through Nabob workings. Nabob has the option to participate, on a 50-50 basis, in such neighboring operations, other than the Sidney mine.

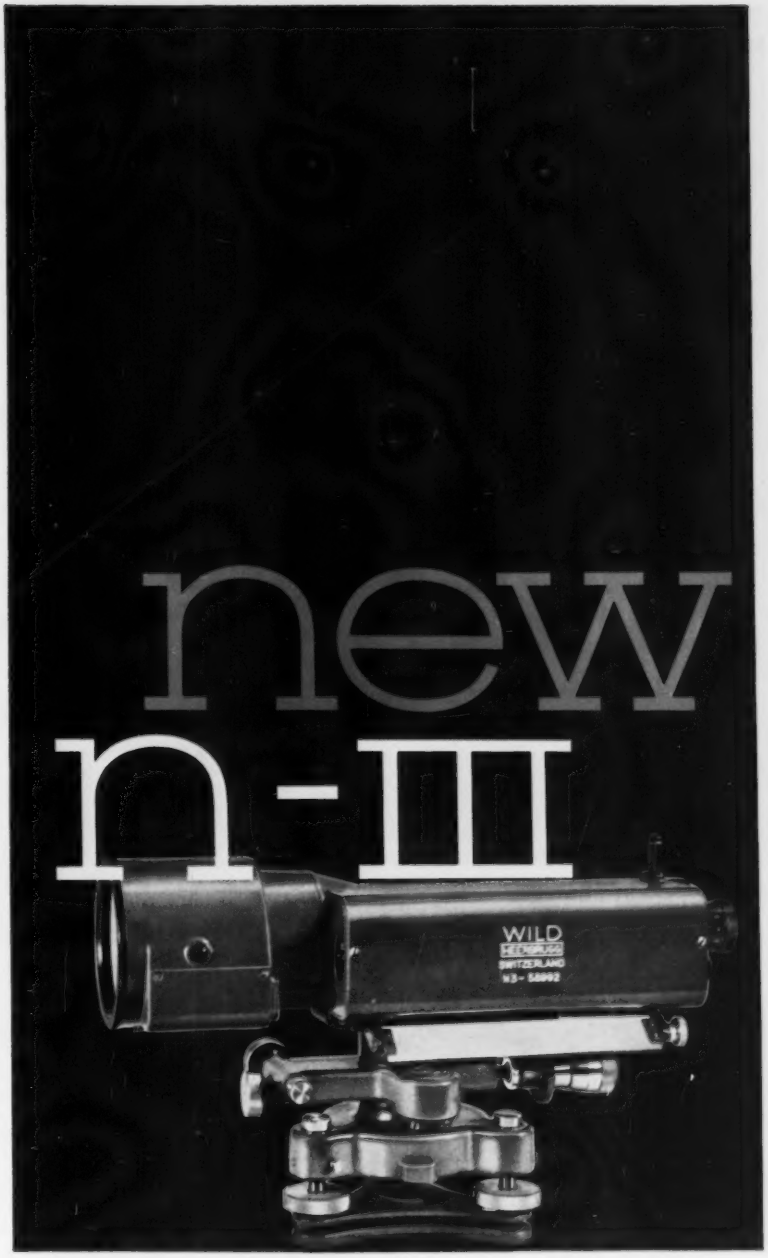
Officials of Lookout Mountain Mining & Milling Co., Caledonia Silver-Lead Mining Co. and Highland-Surprise Consolidated Mining Co. announced plans at Kellogg, Idaho, for start of a new oil-drilling project near Kindersly, Saskatchewan, Canada. They said the Atlas Engineering Corporation of Kellogg will be the operating agency for the three firms.

The Idaho Bureau of Mines & Geology at Moscow reported that thorite from the Hall Mountain area of Boundry County has been found to be amenable to concentration by tabling. The Bureau reported that beneficiation tests by its technicians have shown that concentrates of up to 30% thorium dioxide can be produced.

It was reported by the Bureau that thorium recovery has been running at only 60% and efforts are being made to step up the recovery rate. Four thorite prospects on the west slope of the mountain were investigated by a Bureau staff member.

Norman Smith, manager of Clayton Silver Mines, announced that work was to be resumed at the company's property in Custer County in January. He said 20 men laid off in September were being called back.

Yreka United Inc., stockholders were advised by company officials that a working agreement has been executed with Bunker Hill Co. for exploration and development of properties merged into Yreka United. The work will be carried



THE WILD N-III HIGH PRECISION LEVEL is universally accepted as the standard wherever absolute accuracy, dependability and ruggedness are paramount considerations. The N-III is easy and quick to set up and operate.

Three models are available to meet both field and industrial requirements, reading direct to .1 mm; .001 inch; .0005 ft.

All have tilting screw, coincidence level and built-in optical micrometer.

Write for Booklet N-III.

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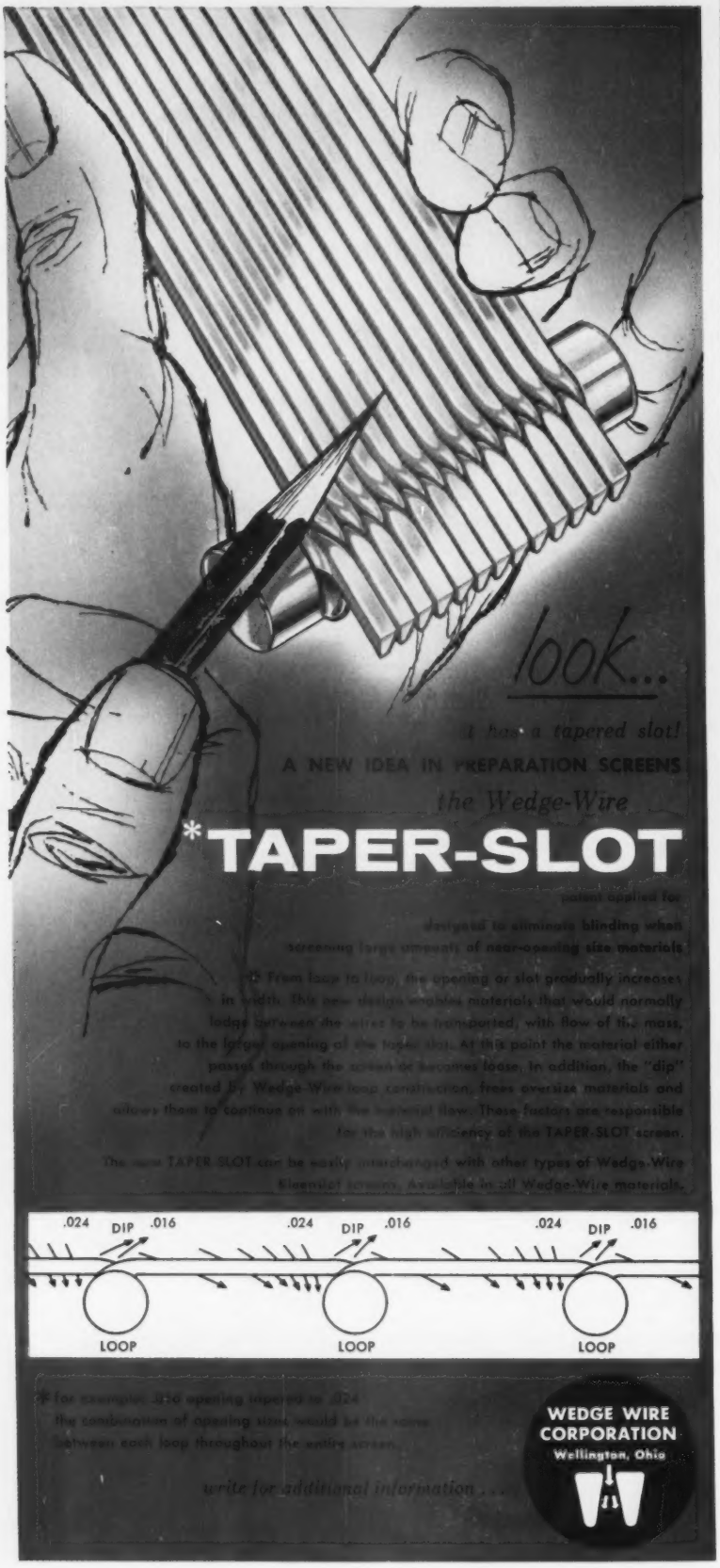


Idaho (*Continued*)

on through lateral workings from a crosscut Bunker Hill is driving between its Crescent mine on Big Creek and its main Bunker operations in Kellogg, Idaho. The tunnel, when completed, will be 18,000 ft in length.

Hecla Mining Co. has exercised its option to purchase 184,035 shares of Lucky Friday Silver-Lead Mines Co. stock from Lucky Friday president Charles E. Horning and vice president John A. Featherstone for $7.50 per share and has made the same offer to purchase the stock of all other stockholders at the $7.50 figure. Stockholders were given 30 days from Dec. 15 to accept the offer. L. J. Randall, Hecla president, sent out a 16-page report to Lucky Friday stockholders on details of the transaction.

MICHIGAN

Cleveland-Cliffs Iron Co. has resumed a five day week at its Cliffs shaft mine in Ishpeming because of an expected demand for the type of hard, lump ore the mine produces. The Cliffs employs 263 men. Other CCI Co. mines on the Marquette range will remain on a four day week for the present.

Inland Steel Co. is operating its Michigan mines on a five day week schedule: the Morris and Greenwood on the Marquette range and the Sherwood and Bristol on the Menominee.

Quincy Mining Co.'s Torch Lake tailings reclamation plant, closed since January 1958, has been reopened. It is handling about 3,000 tpd of tailings, dug by a dredge and pumped to the plant.

About 4700 tons of ore was shipped from the Buck mine at Caspian (Pickands, Mather & Co.) Dec. 22 to the Zenith Furnace Co., Duluth, to produce "a special pig iron." There may be more such shipments "in small allotments" in the future. Only a few of the laid-off Buck employes will be required to fill these orders. The Buck mine has been closed since July 24, 1958.

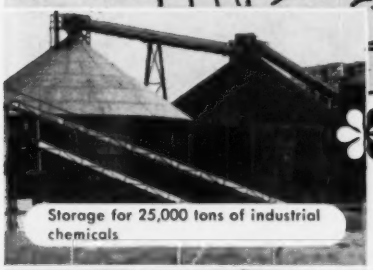
M. A. Hanna Co. was the largest shipper from the Menominee range in 1958 with 1,982,463 tons from the Cannon, Wauseca, Hiawatha and Homer mines producing in that order. Inland Steel Co. shipped 811,299 tons from the Sherwood and Bristol; Pickands, Mather & Co. 184,974 tons from the Buck and Fortune Lake; and North Range Mining Co. 102,388 tons from the Book (closed) and the Warner.

Work at M. A. Hanna Co.'s Groveland mine plant near Iron Mountain is proceeding on schedule and is expected to be ready during the 1959 season. Ground has been broken for the compressor unit. The plant is designed to produce 700,000 tons of high grade concentrates per year.

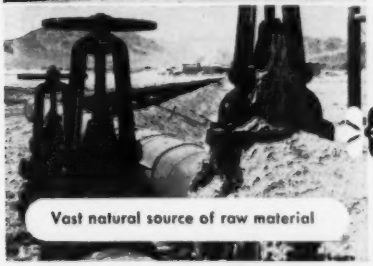
The new shaft being sunk at Hanna's Homer-Wauseca mine at Iron River by Walsh Construction Co. of New York was expected to reach its planned depth of 2741 ft by Feb. 1. Sinking began in

West End "fills the order"...

TO PLANT 9/11 2:35 P M
HAZCO URGENTLY NEEDS EXTRA
HOPPER CAR SODA ASH FROM TANK
6 SHIPPED TODAY. ADVISE. END
TO OFFICE
CAN DO. WILL PULL CAR FROM
STORAGE SPUR AND SHIP TODAY.
CAR NO. NAHX 31078.


Storage for 25,000 tons of industrial chemicals

Immediate shipment in leased hopper cars


Vast natural source of raw material

Meeting service requirements to the letter and producing superior soda ash of consistently accurate particle size and chemical analysis are the essentials to which the West End organization is uniquely geared. A system of rapid communications linking our sales office in Oakland with our production, technical and shipping departments at the desert plant site permits each department head to have a complete understanding of the customer's individual requirements and to make firm commitments or provide the desired information promptly.

WEST END SODA ASH

WEST END CHEMICAL COMPANY

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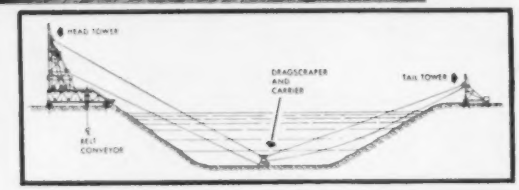
DIVISION OF Stauffer CHEMICAL COMPANY

Tough Digging, Long Hauls... Routine Jobs for Sauerman DragScrapers

240-Ft. Bank... 350-Ft. Haul

This mobile Sauerman Tower Excavator digs 480 yds. per hr. on an average haul of 350 ft. from a high bank to a portable field hopper. The 12-yd. Crescent DragScraper operates between steel head and tail towers. The towers are mounted on two sets of railroad tracks and ride on four sets of trucks. DragScraper power is supplied by two hoists mounted on the head tower. One hoist operates the load and pull-back cables, the other is used to tension the track cable. The hoists are controlled by one operator located in the cab on the tower. The load cable handles over 400,000 tons of material before replacement.



Drawing shows typical mobile tower excavator digging in wet pit.

75 Ft. Under Water... 800-Ft. Span

A 5-yd. rapid-shifting DragScraper supplies about 200 yds. per hr. to the plant hopper in background. Bridle tower in foreground is one of two supporting the bridle shifting cable which is controlled by the third drum of the Sauerman hoist. Lateral shifting of the DragScraper's line of operation is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The DragScraper is digging 75 ft. under water and the operating span is 800 ft. from head frame to the bridle towers. Over a million tons have been excavated from this pit. The DragScraper often operates 24 hrs. a day to handle contract demands.

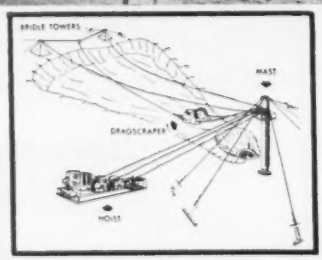


Diagram shows details of Sauerman rapid-shifting DragScraper.

Sauerman machines dig and haul in one continuous operation... work on high bank, dry pit or under water... handle most bulk materials. Consult Sauerman engineers about your job. We will promptly supply appropriate literature.

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LInden 4-4892 • Cable CABEX—Bellwood, Illinois

Crescent Scrapers • Slackline and Toutline Cableways • Durolite Blocks

Michigan *(Continued)*

June 1957, and had reached 2,000 ft in August 1958. Up to the 1958 season, the two mines had shipped over 17-million tons. The new 20 ft diameter, circular concrete shaft will serve both properties. The 11th level will be the first connection between the two old shafts and the one on which ore will first be trammed for hoisting at the new shaft. Hoisting equipment will be built into the headframe instead of the customary separate hoisting building.

The last ore carrier for Menominee range ore, the Cleveland-Cliffs Iron Co. La-Salle, left the Escanaba docks Dec. 3, closing the 1958 ore season. The Escanaba docks are the only iron ore loading docks on Lake Michigan.

Calumet & Hecla, Inc. which has been following a program of diversification, owns a 70% interest in a large magnesium producing plant to be located at Selma, Ala. A new company has been organized to operate the plant—Alabama Metallurgical Corp.

The Bristol mine at Crystal Falls, Menominee range, of Inland Steel Co. is sinking its shaft from the 1600 to the 1900 level. The Bristol was formerly operated by Oglebay, Norton Co. and was closed in 1932. It was taken over by Inland which unwatered it in 1948-49 and began shipping in 1950. It has produced every year since then with its best season in 1957; 353,280 tons. Other Michigan properties operated by Inland are the Sherwood on the Menominee range and the Morris and Greenwood on the Marquette range.

MINNESOTA

The W. S. Moore Co. is enlarging its Gilbert concentrator at the Mariska mine plant in Gilbert. The jigging unit of the fines section will be doubled in capacity. During the past season the plant has added a second ore pocket so that fines and coarse products could be shipped separately. This separation was in use through most of the 1958 season. The Mariska has also handled commercial ores from outside properties during the past three seasons, in addition to its own production.

The winter stripping program at the mine was completed Dec. 1 and repairing is now being carried on at the plant and at the Hibbing shops.

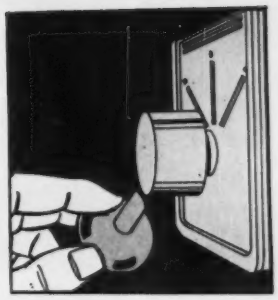
Oglebay, Norton Co. has leased a low grade property in Quebec, Canada, which contains large reserves of taconite with about 25% iron mineable by the open pit method.

Shenango Furnace Co.'s new $8-million ore carrier is expected to be ready to carry Snyder Mining Co. ore for the 1959 season. The new boat will replace the old *Shenango*, built in 1909, and will be called the *Shenango II*.

The last ore boat to leave the Duluth-Superior harbor for the 1958 iron ore

Superior crusher with Hydroset mechanism

Plan to stay ahead... MODERNIZE!



...for balanced circuit or constant tonnage

It's no problem to maintain a smooth, high-capacity flow through the plant when you head your circuit with a *Superior* primary crusher. The exclusive *Hydroset* mechanism in the *Superior* crusher maintains the initial setting and a uniform product by compensating for wear on mantle and concave with just the flip of a switch. This means other equipment in the circuit does not require readjustment to meet variations in material size. Result—constant tonnage, higher plant efficiency with lower operating costs.

If a *Superior* primary or secondary crusher stops under load, *Hydroset* mechanism lowers the mainshaft in seconds to help clear the chamber. Changing crusher settings is a flip of the switch operation, too. Only Allis-Chalmers crushers offer the speed and convenience of a hydraulically controlled mainshaft.

Bulletin 07B7870 will give you all the details. Ask your A-C representative for a copy, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS A-5605

ALLIS-CHALMERS

Superior and *Hydroset* are Allis-Chalmers trademarks.

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METHOD OF PIPING

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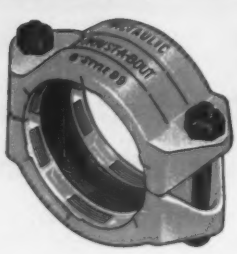
VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

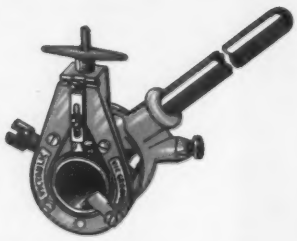


ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. C-2

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Minnesota *(Continued)*

season was the *E.T.Weir* of the M. A. Hanna Co., fleet. She left the Great Northern docks at 1:30 Dec. 1. Some grain ships took on cargoes later in the month.

Jones & Laugh.in's Hill-Annex mine at Calumet has let a contract to Western-Knapp Engineering Co. for a complete renovation of its pit washing plant to be completed for the 1959 shipping season, about April 15. The revamping is designed to effect an increase of about 50% in the crude ore the plant can handle. Spirals and cyclones will be added and the heavy media unit capacity will be doubled. Waste disposal facilities will undergo a corresponding increase. To handle the increased tonnage of crude ore it may be necessary to purchase some new equipment.

A contract has also been let for the construction of a new plant for the company's Lind-Greenway property which is west and south of Pickands, Mather & Co. West Hill mine. The Lind has had no shipments, but the Greenway—formerly operated by Evergreen Mines Co. (1940-44), has shipped 868,449 tons. The two properties will be operated by J&L as one unit. A. C. Seaberg is the local superintendent, John F. Linden is district supt. and H. F. Kullberg, Virginia, is manager of J&L's Minnesota Ore Division.

Jones & Laughlin has a full winter program in progress at all its mines, stripping and other preparatory work for the 1959 season. The Hill-Annex is stripping and also doing some work at its tailings pond strengthening the dams.

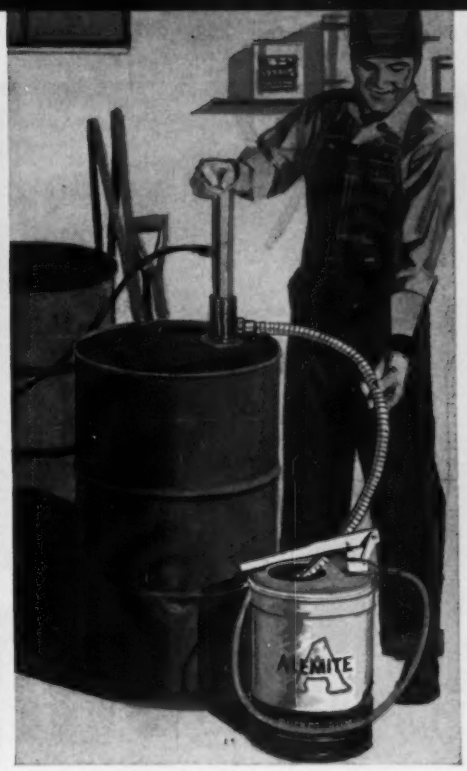
The drop of 30-million tons or more in iron ore shipments from Minnesota mines in 1958 will result in a loss in state taxes of about $15-million. This means a reduction from last year of some $6¾ million in the general revenue fund, $6-million in the school fund, $1½-million in the University fund and $.75-million in the Iron Range Resources Commission.

A dinner was held at the Rainbow Club at Grand Rapids Dec 3 to honor 10 Oliver Iron Mining Division employes who have had 30 years or more of service with the company. George G. Anderson, Coleraine, with 50 years to his credit, was awarded a gold watch, scroll and diamond studded service emblem. There was one man with 45 years, three with 40 years, four with 35 years and one with 30 years of continuous employment.

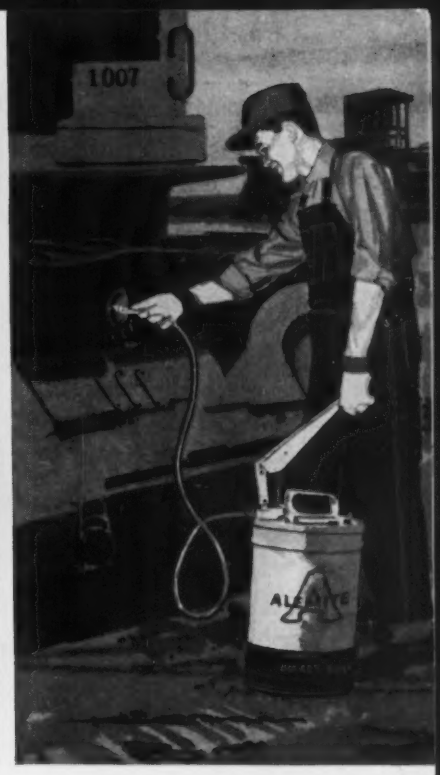
R.O.H. Hawkanson, Duluth, vice-president, administrative, was the principal speaker and E. A. Friedman, general superintendent in the Canisteo district, presented the awards.

On Dec. 4 a similar meeting was held in Virginia at the Coates hotel where 66 veteran Oliver employes were honored. Mr. Hawkanson gave the main address. John Chisolm, general superintendent of the eastern district, presented the awards to four men with 45 years; fifteen with 40 years; thirty-three with 35 years; eleven with 30 years and three

Alemite Loader Pump is 3¾ Man-Hours Faster than hand loading, for every 100 lbs. of grease used! Insures delivery of *clean* grease, free of dust and grit that can cause costly breakdown. Just a few strokes fill gun. Models to fit and seal any original container—from a 400-lb. drum to a 25-lb. pail. No mess—no waste!



Alemite Transfer Pump is 63% Faster than hand method! Transfers 37 lbs. of pressure gun grease per minute, direct from original drum to loader pump, bucket pump or power gun. Lubricant is always sealed—fully protected from contamination or waste. Fully adjustable delivery rate. Weighs only 15½ lbs.!



Alemite Bucket Pump With Adjustable Leverage and Greater Capacity lubricates hundreds of bearings with fewer refills! Handles either oil or grease. Adjustable three ways for using any lubricant in any weather . . . at pressures from 2,500 to 5,000 lbs. Capacity, 35 lbs. Sturdily built for construction industry use.

HOW ALEMITE PUTS MORE JOB-TIME INTO YOUR DAY

. . . and cuts maintenance costs, too!

Faster Lubrication With Alemite Means Less Downtime—More Job-Time!

Heavy-Duty Alemite Hand Guns Save Valuable Time On Toughest Lube Jobs! Handle all pressure gun greases. Spring-primed for positive delivery—long operating handle for maximum leverage. Follower rod disappears after filling. Loader fitting permits fast, clean filling (or gun may be filled by suction). Pressures up to 15,000 lbs.; lubricant capacity up to 24 ounces.

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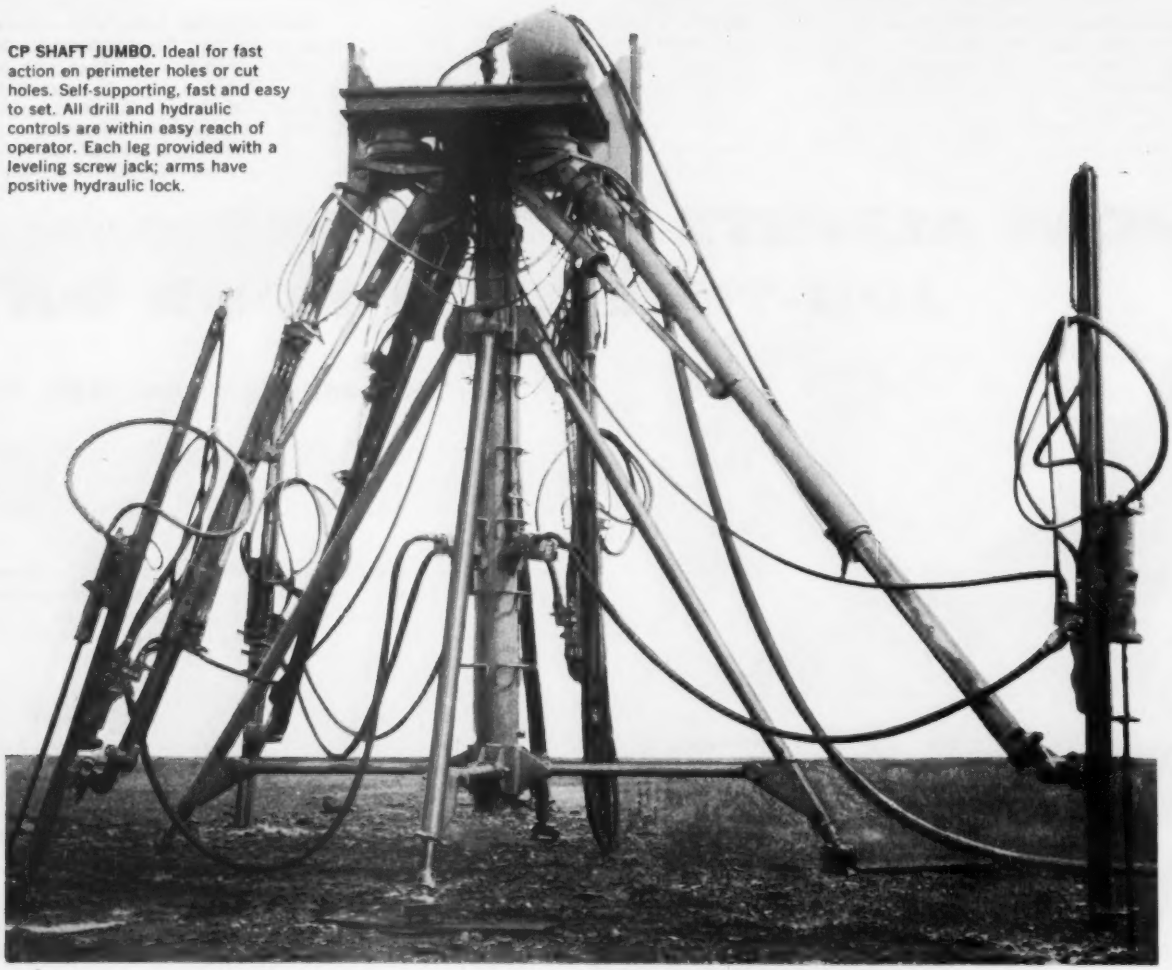
CP-555 ROTAUGER. Its powerful rotary drilling motor and its entirely independent feed motor combine to more than double your footage in the softer formations. Available for wet or dry drilling; drills up to 3" holes, in speeds of 4' to 10' per minute, to depths of 75' or more.

"MECHANIZED

CP SHAFT JUMBO. Ideal for fast action on perimeter holes or cut holes. Self-supporting, fast and easy to set. All drill and hydraulic controls are within easy reach of operator. Each leg provided with a leveling screw jack; arms have positive hydraulic lock.



City..... State.....

NEW CP G-800 TRACDRIL really covers ground . . . has the ability to really move over rough terrain. All drill carriage positioning is hydraulic. Has hydraulically controlled stabilizing pad. Deep-hole drills available: CP-400DR, 4" cylinder bore, 2½" holes to 50'; and CP-450DR, 4½" cylinder bore, 3" holes to 75'.

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Drilling equipment that bears the CP name plate is designed for continuous service where conditions are rough, rugged and rocky. Built to work at top-rated capacity for long hours, CP keeps maintenance at minimum, footage high. All have controls designed to put ease, speed and safety in the operators' hands.

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Other gasoline and diesel-driven models available on skids for test borings . . . capacities to 2250'.

for heavy abrasive slurries with solids in suspension

Where abrasive wear is unusually severe or could cause severe damage if the casing wore out, a Lawrence Lined Slurry Pump provides the answer.

The pump is built with a casing liner, disc liner and impeller made of hard, brittle, abrasion-resistant alloy such as manganese steel, Ni-hard, etc. As the casing is designed to withstand full pressure, the liner can be used until actually worn out. Renewal of both the liner and the impeller (if necessary) is very simple because the casing is split horizontally.

The impeller is made with extra large clearances to prevent clogging. Sealing connections are provided on the suction disc and on the hub to flush out any grit or solid matter to prevent wear at these points.

For complete information about Lawrence Slurry and Sludge Pumps write for Bulletin 207-4.

LAWRENCE PUMPS INC.
371 Market Street, Lawrence, Mass.

Minnesota *(Continued)*

with 25 years of continuous service. The combined service of the 66 men totalled 2,340 years, a tribute to both the men and the company they served.

Oliver Iron Mining Division's Stephens mine crushing-screening plant near Aurora is undergoing revisions that will double its screening capacity. The big 48 x 60-in jaw crusher will be able to serve both screening units. The mine was reopened in 1957 and in its two years of reactivation has shipped about 4.5-million tons of high grade ore. A 1.7-million stripping program is being carried on this winter. The mine has a reserve of over 16-million tons.

On Oct. 29 the Hanna Coal & Ore Corp. became the Hanna Mining Co. as announced by Joseph H. Thompson, president Hanna Mining Co. Mines affected by the change are the West Cuyuna group, Spring Valley (in southern Minnesota) and the Perry and Carlz on the Mesabi. In Michigan the Wauseca and Groveland mines on the Menominee range come under the change.

The 1958 ore shipping season, described as the poorest in 19 years, is over. On Nov. 1 stockpiles of ore at eastern lake ports and furnaces were estimated at 71-million tons: 3-million tons more than one year ago. Furnace men hope that ore consumption during the coming winter will improve sufficiently to create a better demand for ore in 1959.

An iron ore area near Dillon in southwestern Montana is being explored by Minerals Engineering Co. of Grand Junction, Colo. which has shipped 4,000 tons for testing. There is an extimated 200-million tons of ore running 30% or more. French and Canadian concerns are said to be interested in the deposit.

NEVADA

Operations of the iron mining properties in north central Nevada are expected to continue with little change despite the expiration of contracts with Japan in December. During the last few years much of the output has been sent to Japan from the port of Stockton, but domestic markets are expected to take the full production when shipments to the Far East end. Only operation which may be halted for a time is the Dodge Construction Co. mine in Pershing County's Coal Canyon which has been loading an average of 10 railroad cars daily for shipment to Japan, and which has a payroll of 35 men. George Eckman, superintendent in charge of the work, said that unless a new contract was signed in the near future operations might be halted until a new market is located.

Minerals Material Co., one of the large iron ore producers from the Coal Canyon area of Pershing County, expects to ship more during 1959 than it did in 1958, according to Peter Leidich, manager in charge. While shipments have been made to Japan in the past, Kaiser Steel Corp. at Fontana, Calif., has been

"Stoody SEMI-AUTOMATIC Hard-Facing

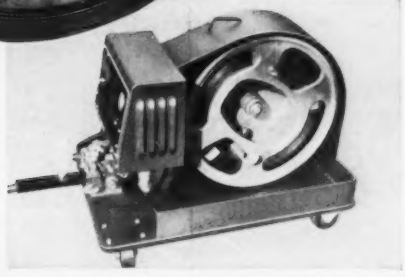
Splits my work in half!"

Here's a welder's own words about semi-automatic hard-facing on roll crushers..."I can do as much work in 4 hours with Stoody Semi-Automatic Hard-Facing as I used to do manually in 8 hours. The metal doesn't get as hot, and I can make a higher, wider bead —with less effort. You just can't beat these machines for hard-facing no matter how hard you try."

If you want to cut down on your own work, if you want to *accomplish more* in a given time, you should try Stoody Semi-Automatic Hard-Facing!

We'll be glad to arrange a free demonstration in your plant, hard-facing *your* parts. You be the judge!

Stoody semi-automatic wires are supplied in continuous coils and can be fed through most standard types of semi-automatic welding machines. A wide variety of alloy types cover all job requirements.



Literature is available.
Ask your nearest Stoody Dealer or write direct to the company.

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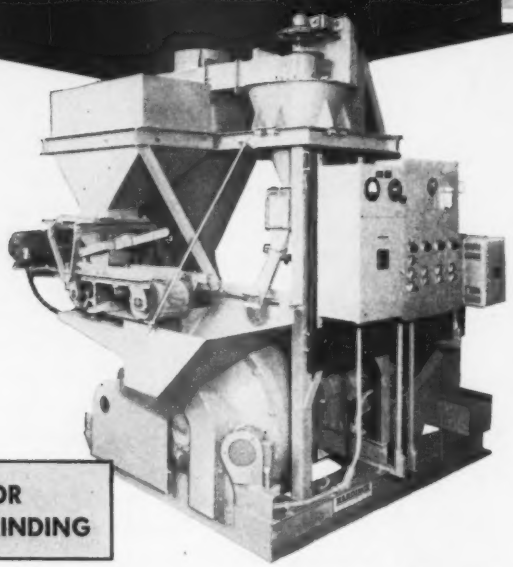

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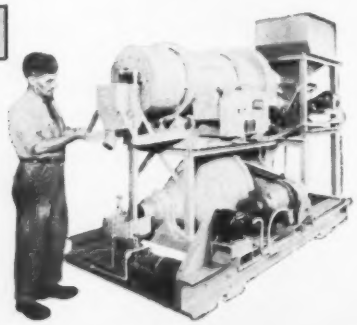
For any small-scale continuous dry grinding or pulverizing problem (such as is found in a pilot plant, laboratory or small commercial process) the Hardinge dry grinding unit is the solution. Completely self-contained and portable, this unit requires only power connections to be placed in operation. Includes Constant-Weight Feeder, "Electric Ear" grinding control, Conical Mill, "Gyrotor" Air Classifier, product collector and dust collector.

FOR WET GRINDING

Hardinge builds a similar unit (right) for small-scale wet-grinding applications. The "package" includes mill, classifier, feeder, "Electric Ear", and launders.



Bulletin AH-448-1

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COMPANY, INCORPORATED

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Nevada *(Continued)*

buying large tonnages and other markets are also in sight. Minerals Materials shipped 120 carloads of ore during December. Ore is loaded on Southern Pacific cars at Colado, six miles east of Lovelock.

Nevada Iron Ore Co. is shipping an average of 60 cars per month from firm's mining property in Pershing County. Southern Pacific cars are loaded at Woolsey and shipments are made to the Kaiser Fontana mill. H. S. Thomas, of Lovelock, president of the company, says he expects operations to continue undiminished during 1959.

The Iron King Mine at 8,000-ft elevation 60 miles northwest of Winnemucca in Humboldt County is shipping an average of 1,600-tons of high grade iron ore weekly from the Western Pacific loading point at Jungo. Shipments are made to the Youngstown Sheet & Tube mill at Gary, Ind., and Will Austin, head of the company, says no change is expected during the coming year.

White Caps Gold Mining Co. is testing the ability of a small electric furnace in Los Angeles to recover antimony and quicksilver from the complicated ore from the firm's mine at Manhattan in Nye County. Heretofore the ore has yielded gold, but antimony and quicksilver values have not been recovered. A shipment of 20 tons of ore was made to the Los Angles plant for testing, and if results are good an outside interest has agreed to erect a similar furnace at the Manhattan site and operate it on a 50-50 basis. Pumps in the White Caps mine are reducing the water level from the 800-ft stope to deeper parts of the property where 10,000 tons of antimony ore and 8,000 tons of antimony-gold ore have been blocked out. Hugh Cameron is superintendent of the White Caps operation, and George Rong is mine foreman.

Ore from the April Fool Claim mine which White Caps is developing in the center of Manhattan is running well over $60 per ton, according to a report from the Kennecott Copper Co. smelter at McGill, where the first ore shipment was processed. Values were reported at 1.75 oz gold and 1 oz silver. Due to its situation beside the Manhattan post office, production from the property is now only two tons daily, but the output is expected to be increased in the near future.

Directors of the U. S. Milling & Minerals Corp. met at Tonopah Dec. 15 and decided to increase production at the company's mining properties now in operation at Gold Point and Silver Peak, both in Esmeralda County. Present for the meeting were M. J. Robbins, J. L. Sachs, S. Rappeport and S. A. Robbins, all of Chicago; Earl Wechter, of Glencoe, Ill., E. L. Kromer, of Highland Park, Ill., and Nevada officials, S. L. Levine, president, A. W. Rischmiller, vice president, and George F. Reed, general manager. The company's mill at Silver Peak is at present processing more than 200 tpd, and is operated by a 16-man crew. Custom ore is being sent in from

USERS OF **NEW**
ROEBLING HERRINGBONE* WIRE ROPE
HOLD THESE TRUTHS TO BE SELF-EVIDENT...

That Herringbone is the most practical and *needed* wire rope development to come along in years.

Herringbone, the regular lay and Lang lay rope, is actually two-ropes-in-one rope. Thus, the qualities that make these two ropes *good* ropes, combine to make Herringbone *excellent.*

HERE'S WHY:

The steel core of Herringbone provides the *ideal* support for the two pairs of Lang lay and one pair of regular lay strands used in its construction. In addition, the outer wires are heavier for extra abrasion resistance, and good flexibility is maintained by the finer wires inside. This combination of features enables Herringbone to give *longer service* in most applications.

Herringbone has been used on a wide variety of excavating equipment and tough hoisting jobs with impressive results. Its applications are practically unlimited on installations which call for all-steel ropes and on many where fiber core ropes are now being used. Another of Herringbone's added attractions is the fact that it eliminates the necessity for stocking Lang lay rope for one job and regular lay for another.

Your Roebling Distributor has Herringbone right now. He has, also, copies of a brochure describing Herringbone, the newest Roebling Star Performer. If you wish, write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for literature and anything you'd like to know about Herringbone.

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Are you faced with a really tough problem in sizing . . . scalping . . . washing . . . rescreening . . . dewatering? The *right* Hewitt-Robins screen is your answer!

Vibrex: Here's the most versatile screen of them all! Simple, field adjustable, stroke, speed, angle to match any requirement . . . circle-throw principle with two massive self-aligning bearings . . . rock-bottom economy coupled with long-life ruggedness!

Eliptex: Exclusive elliptical motion for horizontal operation gives high capacity, fast material progression, and sharp sizing.

Gyrex: This positive-stroke, four-bearing, circle-throw screen has an unsurpassed record for stamina.

hi-G: A modified-resonant unit that has the extra kick for hard-to-screen materials at only a fraction of usual power requirements. Both decks are accessible for cloth changes.

All *4* in standard *suspended* and *base mounted* models!

Whatever your specific screening problems, you will find one of these Hewitt-Robins units *best* fitted for the job. For information or service, contact your local H-R representative, or Hewitt-Robins, Stamford, Connecticut.

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CONVEYOR BELTING AND IDLERS . . . POWER TRANSMISSION DRIVES
INDUSTRIAL HOSE . . . VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

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Nevada (*Continued*)

Tonopah, Virginia City, Mammoth Lake and Bridgeport.

Kennecott Copper Co. during December added 160 workers to its staff at the Ruth-McGill operations in White Pine County, and also reestablished the seven-day work week. The action will add $1-million dollars to the annual payroll in the Ely area. Under the new schedule employes will work a five-day week at the mines and a seven-day week at the concentrator and smelter. The increase in the operating schedule is the third since August.

Kennecott also announces that a skip installation on the north side of the Liberty Pit is now completed, and trial runs were scheduled for Jan. 19. The skip track is 1360 ft long with an incline of 19 deg. and a vertical lift of 435 ft. Excavations for the project were estimated at 1-million tons, of which 540,000 tons were for the skipway and 560,000 tons for yards, tracks and roadways. A double drum, direct current electric hoist, with motor, controls and related equipment capable of hoisting 1,000 tons of ore or waste per hour have been installed. The skips are of 25-ton capacity and will operate in counter-balance. They will discharge into two ore bins, each with a level capacity of 100 tons and a surge capacity of 180 tons. Mechanical feeders will permit loading cars on either side of the bins.

Spardome Mining Co. is developing a fluorspar property in the Gabbs area of Nye County and reports encouraging results. Floyd J. Miller, manager of the company, says a diamond drill program is in progress and that good widths of fluorite ore have been encountered on the 175-ft level of the mine. Boyle Bros. Drilling Co. is doing the work.

Dr. J. D. Bateman, mineral geologist for Ventures, Inc., of Canada, spent three days in and around Tonopah during December, investigating selenium, nickel and cobalt deposits in Nye and Esmeralda County.

An extensive geological survey and drilling program are underway at the cinnabar properties of Dr. Paul C. Goddard, Gerald Kennedy and Lloyd Trickey in the Tybo mining district of Nye County. Extensive development has already been done on the M. & M. property nearby. The area was a major producer of quicksilver in years gone by and the operators, who all live in Tonopah, are expecting to resume production early in the spring.

Developments in the production of pure cerium at the Reno station of the U. S. Bureau of Mines were discussed at the December meeting of the Reno subsection of AIME. Donald J. Bauer, a staff member at the station, described both the development of equipment and the process used for producing electrocerium ingots of 99.9% purity. Laboratory work used in the process was described by Edward Morrice, another staff member, who said that positive control of cell atmosphere, composition pressure and

The Standard of Comparison for GRINDING ECONOMY

Sheffield alloying, forging and heat treating techniques assure the right combination of hardness and toughness—right to the core of the ball. Result: longer service life, less down-time, greater production economies. Something to remember next time you order grinding balls.

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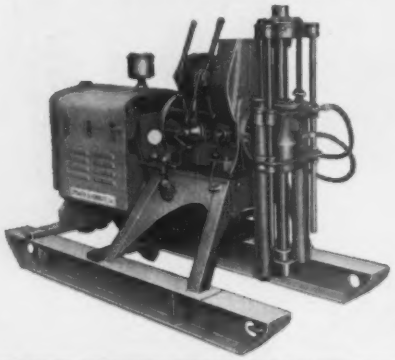

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40-CL

We've heard this phrase over and over again from our many customers. They know that it is unsurpassed for foundation investigation, mineral exploration, and grout hole drilling.

THIS IS WHY THEY BOUGHT A 40-CL

- STABILITY — Wider, longer skids and a sturdy steel frame make it very difficult to tip even when moving in mountainous terrain.
- DEPENDABILITY — The heavy-duty wire line hoist coupled with a rugged power unit offers more hoisting power than you'll ever need at the rated capacities.
- ADAPTABILITY — The choice of . . . power units, screwfeed or hydraulic swivelheads in varying spindle sizes, four transmission speeds and the availability of a side-mounted cathead and a built-in retracting mechanism makes the 40-CL adaptable to most drilling jobs.
- MOBILITY — The 40-CL has a built-in set of sheaves to facilitate movement under its own power. In addition a low-bed trailer is available that permits the use of the rig directly from the trailer mounting in locations where the terrain permits.
- QUALITY — Careful machining and time-tested inspection methods substantially increase the trouble-free drill life.

If you want a machine for truck mounting, ask about our 40-C TRUCK-MOUNT. When you want an "all-round" core drill machine, remember that the 40-C and 40-CL Core Drills are just the machines for you.

Look for our emblem... It's your Seal of Quality

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Nevada *(Continued)*

temperature was necessary in obtaining the results.

Standard Slag Co. which is producing uranium ore from its properties near Mountain City in northern Elko County, reports that ore reached by open pit mining now has a depth of 100 ft. Drilling operations are in progress to determine if a vein formation can be found. On a nearby claim Tom White and Riley Chambers, both of Mountain City, have discovered a high grade autonite showing which indicates substantial values near the surface, similar to those being developed by Standard Slag.

Harold Langford and Tom Kelly report that work has been progressing steadily at their mining property on Columbia Mountain in Nye County. Work on the long tunnel at the mine has been completed, and 500 tons of good gold ore has been stockpiled. The owners report that the vein system is showing an increase in width and values as the development continues.

Thunderbird Development Inc. has resumed work on the mine tailings at Millers, north of Tonopah. Syd Cox, president of the company, returned to Nye County during December and said financial and organizational problems of the firm had been ironed out, and that operations will continue indefinitely. A shutdown occurred last fall. Most of the necessary machinery is now in place and it is believed that full scale production will be attained in the near future.

Fiberboard Paper Co., which is operating gypsum mines in the Henderson area of Clark County, reports discovery of "one of the world's largest" gypsum deposits in that vicinity. William L. Keady, president of the firm, estimates the newly discovered reserve at 750-million tons. The deposit is about 50 miles from Las Vegas and is expected to be in production within a year.

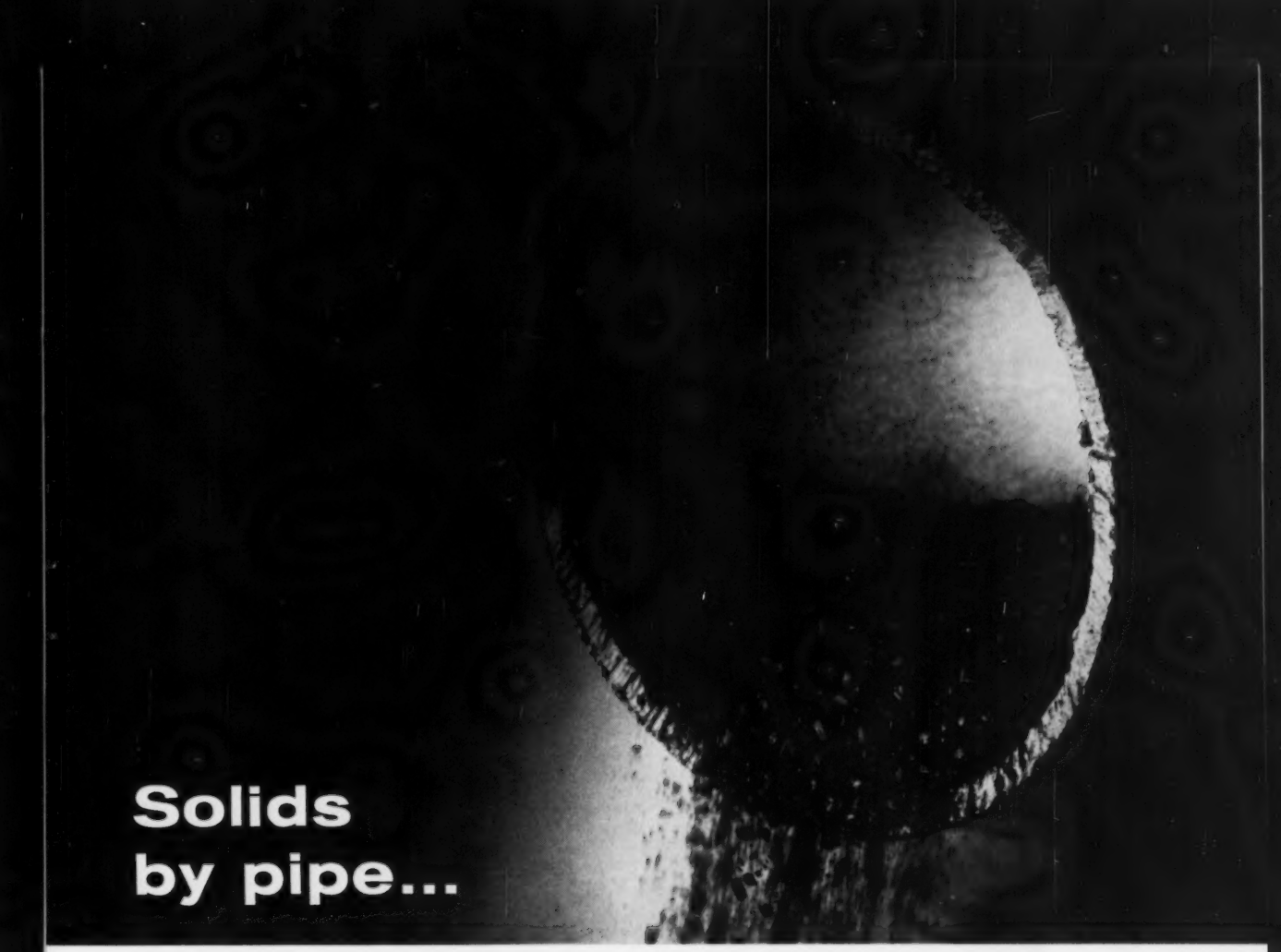
NEW MEXICO

Atomic Energy Commission has issued an allocation for reserves and mining rate to Quinta Corp., a uranium firm with a substantial deposit in Grants area of McKinley County.

The AEC letter to Victor Salazar, Quinta president at Albuquerque, stated that Quinta had been given an allocation equal to production of 143,000 lb annually of U_3O_8 and a yearly tonnage output of about 595,000 tons of ore.

A Grand Junction Operations Office spokesman said that Quinta's arrangement for milling the ore would be subject to approval of AEC. Phillips Petroleum Co., a part owner of the ore body, is expected to find room for milling of the ores at its recently completed mill in the district. The reserve allocation extends through Dec. 31, 1966.

Mining operations at Parador Mining's Elizabeth Adoor Claim No. 1 at Ambrosia Lake is to start in March it



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Gilsonite . . . coal . . . *what raw material will be next* to start moving to market through a pipe?

As you get set to meet the mighty challenge and opportunity that solids pipelining presents to your industry, remember this:

1. Men who engineer solids pipeline systems find that *uniform concentration* of solids is a must in a pipelined slurry.
2. You can get the slurry uniformity you want—with LIGHTNIN Mixers.

LIGHTNIN Side Entering Mixers keep 700 tons of solids per day uniformly suspended for dispatch through the pioneer American Gilsonite Co. pipeline. LIGHTNINs in thousands of chemical plants mix slurries of every kind, rapidly, dependably—*to the exact level of uniformity needed.* If it can be slurried, you can slurry it *uniformly* with LIGHTNINs.

If you'd like quick, competent help on slurry suspension for a specific project, call in your LIGHTNIN Mixer representative now. He's listed in Pipeline Composite Catalog. Or write us in confidence.

Good mixing helps move Gilsonite over a mountain

Solids pipeline built by American Gilsonite Co. makes the refining of gasoline from Gilsonite economically possible. It saves more than $4 per ton—a million dollars a year—over other methods of transporting Gilsonite ore over a mountain from mine to refinery.

American Gilsonite's 6-inch pipeline carries slurries averaging 38% solids and 62% water at 350 gallons per minute. It delivers more than 700 tons of solids per day at the downstream end, 80 miles from the eastern Utah mine.

Cut from the solid vein with high-pressure jets of water, the shattered ore is flumed more than a mile underground to the bottom of the 800-foot-deep central shaft.

Then the ore is screened to 8-mesh maximum, pumped to the surface with fluming water, and mixed to uniformity in 200,000-gallon holding tanks equipped with LIGHTNIN Side Entering Mixers.

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OR VERY SMALL...

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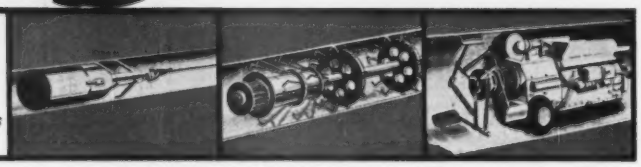
3 *processes*



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

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CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

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outside pipe coating which may be applied either at the central Wilmington, California, plant, or at railhead plants elsewhere.

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New Mexico *(Continued)*

was announced by John Bastanchury, vice president of Parador Mining Co. of San Francisco.

A shaft will be sunk to a depth of 1150 ft, where the base of the main ore body is located. It is expected that production from the mine will begin in April 1960.

NEW YORK

W. S. Moore Co. is continuing its exploration program on a magnetic ore deposit in the Star Lake area. Robert E. Simon has been resident engineer in charge of the exploration work for over two years.

SOUTH DAKOTA

Measured uranium ore reserves in the Black Hills region are now estimated at 1-million tons, according to a statement by Mines Development, Inc., owners and operators of the Edgemont uranium mill. The reserves are reported to have a gross value, after processing, of over $40-million.

John Hoffman, district representative for the Edgemont Mill, states that there have been substantial discoveries of ore in the past two years in the Southern Hills area of South Dakota and in northeastern Crook County in Wyoming. While original deposits were principally on or near the surface, the more recent discoveries have been at depths of from 200 to 350 ft.

Significant discoveries of new ore have been made by the Homestake Mining Co., Montana Chemical & Milling Corp., Pictograph Mining & Uranium Co., Inc., Giant Cycle Corp., B & H Mines, and the Chord Uranium Co.

UTAH

International Smelting & Refining Co. (Anaconda Co.) has purchased slag dump and 31 acres of ground at site of the old Asarco smelter in Murray.

Asarco closed its smelter (lead blast furnace) at Murray in about 1948 after 50 years' of operation.

W. J. (Pat) McKenna, manager of Tooele plant of IS&R said the slag dump contains some 1½-million tons of material running from 4- to 7% zinc. There are no other metal values which can be recovered, he said.

Even the zinc recovery in the Tooele zinc fuming plant is problematical at today's prices for that metal, McKenna said.

Slag will be run experimentally as a result, he said.

Wells Cargo, Reno, Nev., mine contractors and truckers, has been given contract for "mining" the dump. Shipments to Tooele plant will be made by rail car.

Crews of Utah Construction Co. are now more than three miles in on the new ore haulageway for the Bingham Pit,

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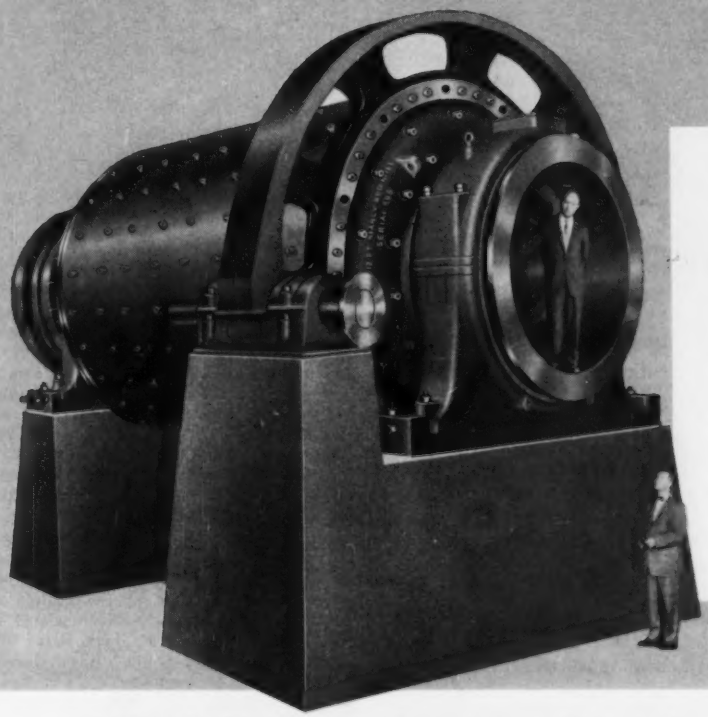

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Utah *(Continued)*

Utah Copper Division, Kennecott Copper Corp.

The 18,000 ft, $11-million project, was started in November 1956 and is "ahead of schedule," it was announced.

Completition is expected early this spring.

The tunnel will connect with the bottom of the famed open cut mine and the Copperton assembly (rail) yards. When completed this spring (in terms of length) the tunnel will be probably somewhat below present pit bottom.

It is 18 X 24 ft, will accommodate a single, standard gage track with centralized traffic control. The tunnel will be concrete lined.

Speed in driving was attained in recent months as the tunnel left a fractured shale formation and returned to quartzite rock —which doesn't require extensive reinforcement.

The Intermountain West's last public ore sampler has been sold to J. J. Coan Co., Salt Lake dealers in used and new mining and metallurgical machinery.

Utah Ore Sampling Co. at suburban Murray, near Salt Lake City, had been operating for 50 years as successor to Taylor & Brunton, a public sampler founded at Midvale in the 1880's.

E. G. Jensen, president of Utah Ore Sampling, said the sale of plant and equipment was made because custom shippers of non-ferrous metal ores and concentrates had declined to such a point operations were not profitable. The Midvale smelter of United States Smelting & Refining Co. is in process of closure and will be sold.

The AEC is being asked by producers in Idaho and two Utah mining districts to extend the same kind of consideration on 1962-1966 purchasing that it plans for the Uravan mineral belt miner.

AEC in its recently published promise to buy concentrates at $8 a lb between March 31, 1962 and Dec. 31, 1966 from ores found as of Nov. 24, 1957, provides for adjustment in case of small miners whose reserves cannot be adequately determined. Some of the miners do not know reserves past 60 to 90 days.

Vitro Uranium Co., a division of Vitro Corporation of America, operating mill at Salt Lake City, has assigned a man full time to assist independents in Utah's Marysvale and Green River districts and Idaho's Stanley Basin district in evaluating their reserves.

It is on basis of these reserves, in part, that Vitro expects to negotiate contracts for concentrates sales in the 1962-66 period. The firm's present contracts expire March 31, 1962.

Without the Salt Lake mill, and in view of the end of producer-haulage allowance in the AEC's 1962-1966 plan, the miners in these off-Colorado plateau areas may face serious economic hardship it is stated.

Vitro appears to be the only mill with available capacity within economic range for their ores.

The Commission's Grand Junction

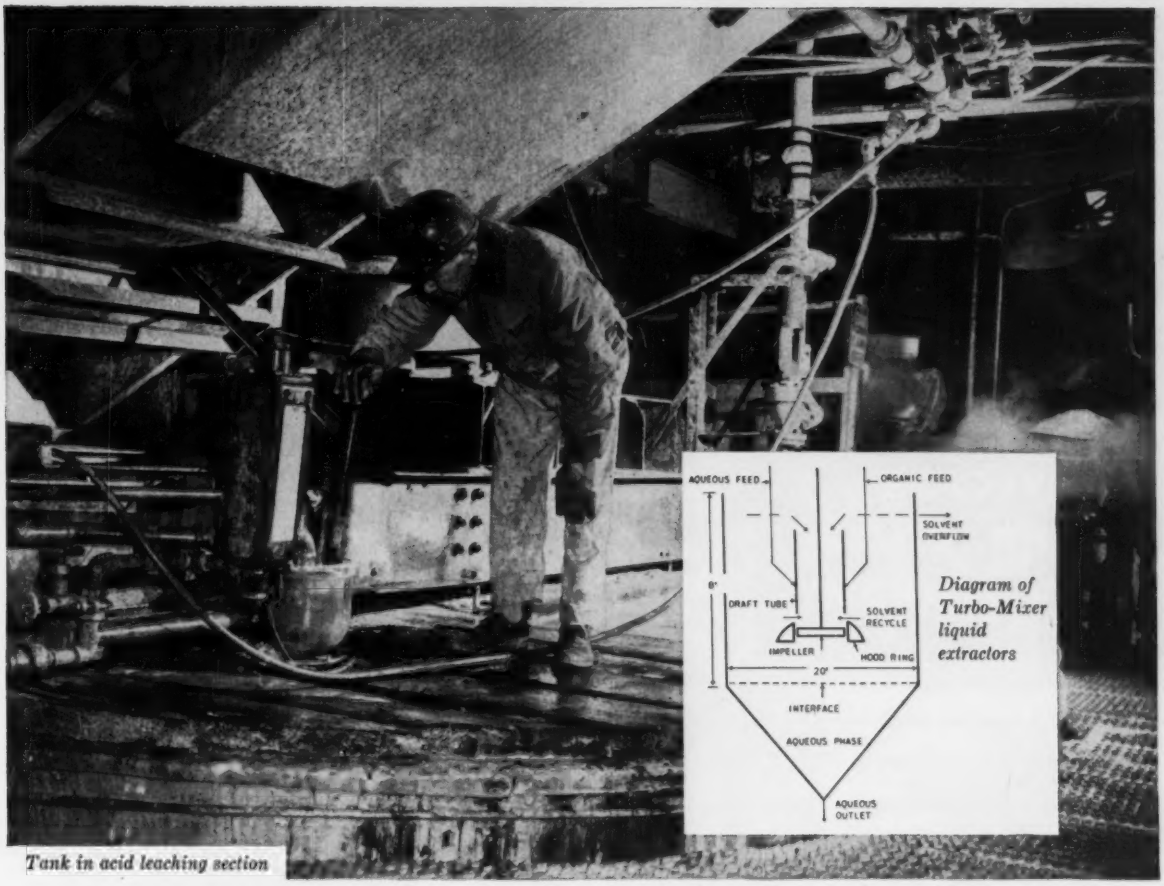

Diagram of Turbo-Mixer liquid extractors

Tank in acid leaching section

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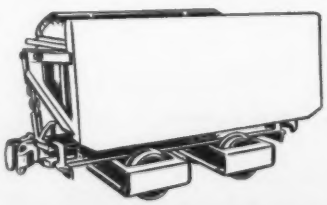

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Utah *(Continued)*

Operations Office is studying the situation.

Utah has oil shale resources of the nature most likely to be found economically recoverable by release of atomic energy, according to Frank J. Allen, director of the Utah State Land Board.

He wrote the Atomic Energy Commission about its "Ploughshare" program which involves possible experimenting with underground explosions releasing the shale oils in "in situ."

Mr. Allen believes that Utah shales, because of their heavy over-burden (they are largely between 1,000 and 2,500 ft underground) offer better opportunities than shales of other western states for "atomic prospecting."

The Utahn said that if AEC at its Las Vegas office is discussing possibility of such an explosion, the Land Board would like to have an engineering representative in attendance at the talks.

VIRGINIA

A contract for construction of an ore dressing plant at Newport News has been awarded by Union Carbide Ore Co. division of Union Carbide Corp., to Tidewater Construction Corp. of Norfolk. The new plant will be used for processing manganese ore from affiliated mining operations located in British Guiana. Tidewater will start construction early this year on property owned and occupied by Union Carbide. Completion of the project has been scheduled for May 1960.

The new plant will grade and classify approximately 30,000 tons of ore a month. There will be about 75 employes. Most of the processed manganese ore will be shipped from Newport News by rail to the plants of Union Carbide Metals Co., another division of the corporation, for use in the production of alloys.

WASHINGTON

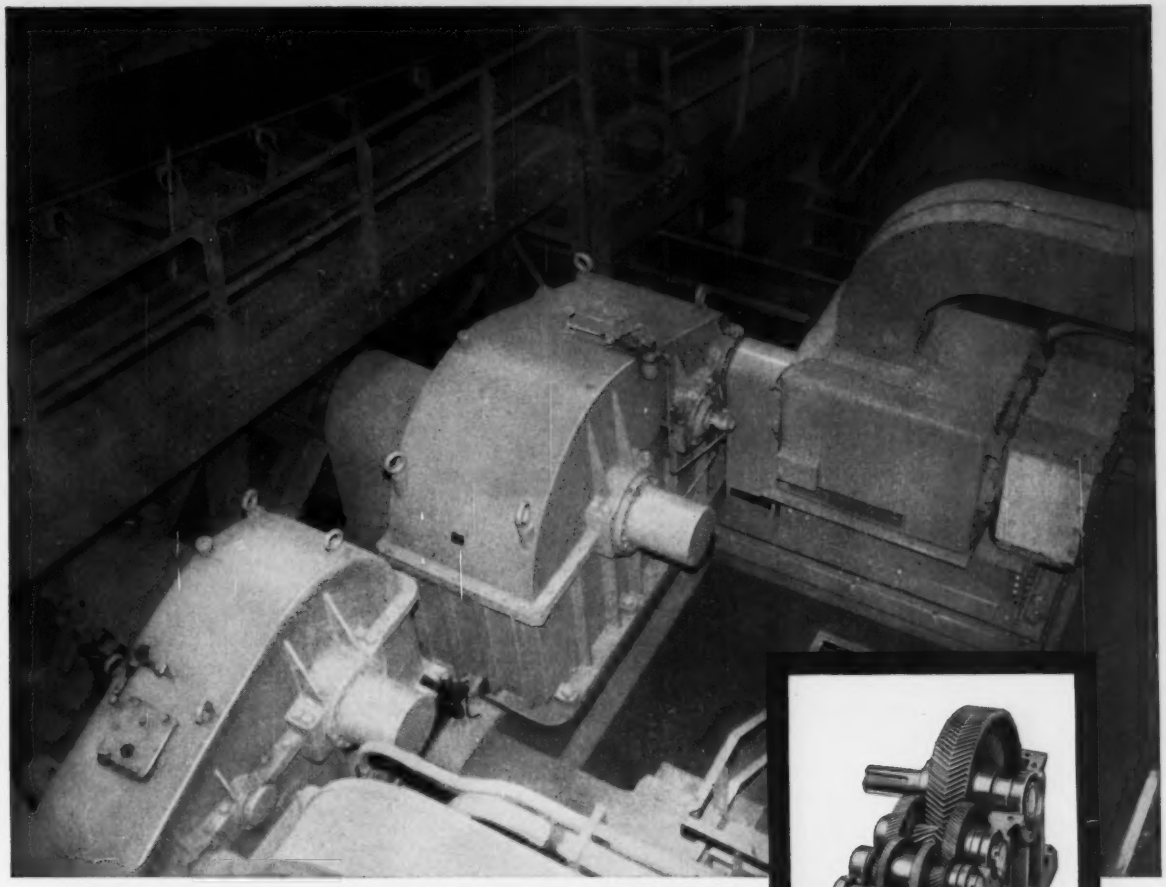
Officials of Utahcan, Inc., Spokane, said that work is being pushed to complete the company's new mill in northern Pend Oreille County.

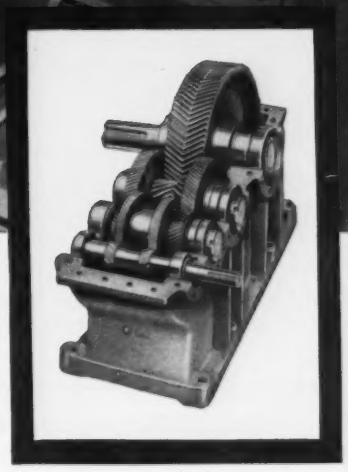
Roy Lorang, president of the firm, said the company hopes to start open pit mining and milling operations by April 15. A 100-ton capacity mill is under construction at the property.

Frank Wiegle, formerly with the staff of Bunker Hill Co. at Kellogg, Idaho, is mill superintendent for Utahcan's lead-zinc operation.

Stockholders of North Star Uranium, Inc., Spokane, at an annual meeting Dec. 13, authorized expenditure of company funds to participate in an oil development venture in Oklahoma with Bismarck Mining Co., Callahan Consolidated Mines, Inc., and R. Stanley Evans, all of Spokane.

The three companies and Evans each





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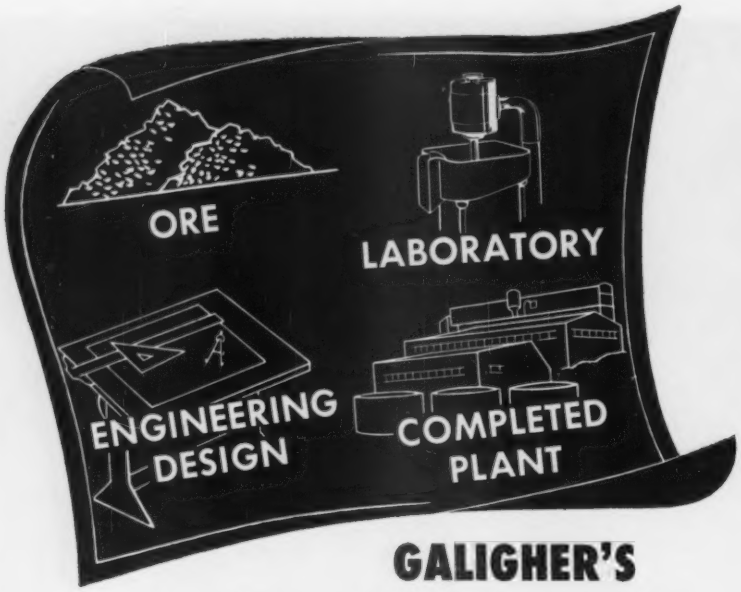

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Washington *(Continued)*

have a 25% interest in the project. North Star has been engaged in uranium mining operations in the Mount Spokane district for the past two years.

Northwest Refining & Chemical Co., Spokane, which has developed a new process for producing zinc oxide and by-product fertilizers, announced that it has acquired the Admiral zinc mine and mill located in northern Stevens County.

John A. Allen, president and general manager of Northwest, said that the mining property was obtained from the Deep Mining Co., Bonneville, Ore. He said that the property will give the company its own source of supply for the manufacture of zinc oxide.

Blue Star Mining & Survey Corp., Colville, said it plans to begin drilling operations in the Arden and Deer Lake areas of Stevens County. C. E. Tedrow, Spokane area mining engineer, said in a geological report prepared for the firm that both areas have a potential in uranium and tungsten. Land has been leased in both districts.

WYOMING

Wyoming's first sulphuric acid manufacturing plant has commenced operations.

The 100-tpd plant, owned by Fremont Minerals, Inc., is located at Riverton, and constructed at a cost of $750,000.

The plant utilizes the contact process, which produces acid through the burning of pure sulphur and conversion of the resulting gases. Sulphur for the plant is obtained through local Wyoming suppliers who recover it from sour natural gas.

A 161-acre tract of state-owned land sought by Columbia-Geneva Division of U. S. Steel Corp. was to be sold at public auction in Lander Jan. 12.

Columbia-Geneva sub-leased the land recently from Leaseholder Paul Crofts as a site for a sedimentation dam.

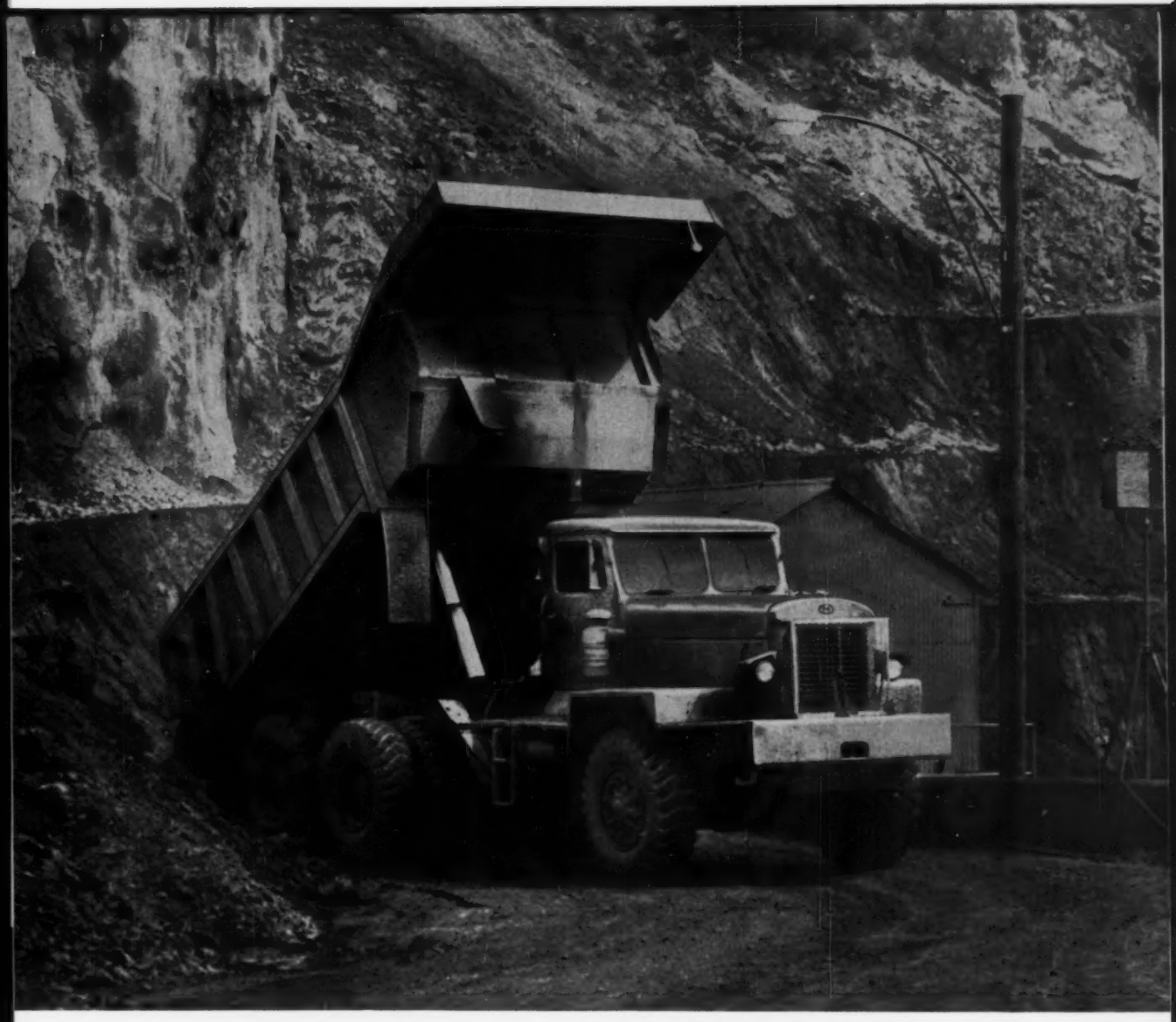
Although Columbia-Geneva has not announced definite plans to proceed with construction of an iron ore processing mill in the Atlantic City area south of Lander it has been continuing to acquire property and water rights in the area.

The 161-acre tract is located 2 miles north and a mile west of Atlantic City. Columbia-Geneva has been conducting tests for the past two years on feasibility of developing the taconite deposits in the area. The ore would be shipped to the firm's mills in Provo, Utah.

Construction of a uranium upgrader or mill at Linch is being considered by Mountain High Uranium & Oil Corp.

Noel Edgeington, president, said Mountain High has 149 claims embracing 2,900 acres in the Pine Ridge area of Johnson County, which it is developing. Pine Ridge is north of Linch and west of the Pumpkin Buttes area.

Edgeington said 60,000 ft of core drilling has produced evidence of commercial grade ore and work is under way to stockpile 1,000 tons at Linch.



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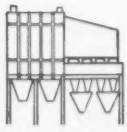

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IN CANADA

NEWFOUNDLAND

Atlantic Coast Copper Corp. is to carry out a thorough diamond drilling program on its copper property in the Little Bay area to check fully the orebody indicated in previous drilling. During the past year the company has completed a shaft to 1,050-ft depth following which a line drive was put out some 1100 ft in the footwall of the ore zone. Previous surface drilling indicated an estimated 2-million tons averaging 2.1% copper. In addition an estimated 216,000 tons grading 1.48% remain in old dumps from operations carried out by previous operators many years ago. Operations are under management of O'Brien Gold Mines which together with Combined Metal Mines is participating in the financing.

ONTARIO

Delnite Mines is well along in its deep development program on three new levels at the gold producing property near Timmins. Three new levels were opened up at 4975, 5100 and 5250-ft depths. Initially, work is being pushed on the bottom level to permit opening any existing ore and to provide for drilling stations to test deeper horizons. The drive has some 820 ft to go to reach the projected ore zone which, it is expected, will be entered by April.

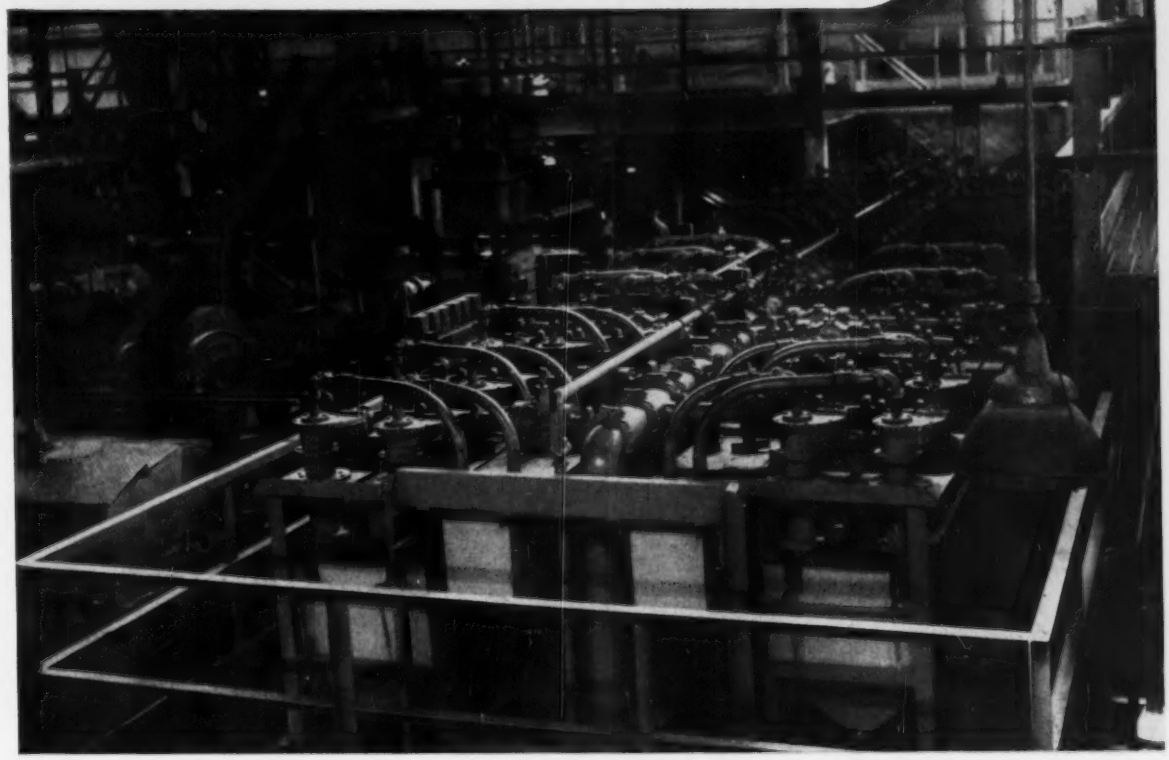
Wright-Hargreaves is reported opening fine ore at depth at its gold producing property in the Kirkland Lake area. Some 2,541 ft of ore averaging 0.6 oz gold per ton ($21 at $35 per oz) has been exposed on the block of six new levels between 7200 and 8100 ft. The greatest length, 929 ft, was opened on the bottom level. During the current year it is planned to carry out diamond drilling below this level.

Jonsmith Mines has come up with a brand new molybdenite discovery in Derosiers Twp., some 30 miles northwest of Gogama. Initial work has disclosed two separate showings. Trenching has been done along a length of 60 ft on one showing with both ends still open. Grade is 0.63% molybdenum over width of 5.0 ft. The second showing is 430 ft long varying in width from a half foot to 3.0 ft.

International Nickel Co. of Canada has scheduled production at its nickel-copper mines and plants in the Sudbury area at a rate about 20% higher than before the 3-month strike which ended at the close of 1958. The new rate is about 10,000 tons each of copper and nickel per month. Capacity operations are around 13,000 tons monthly for nickel and slightly less for copper.

During 1958 Macassa Mines opened a total length of 1988 ft of new ore grading 0.48 oz gold per ton in deep level

KREBS CYCLONES handle more than 90% of all U. S. uranium tonnage



THE ANACONDA COMPANY (NEW MEXICO OPERATIONS) has 48 Model D4B Krebs Cyclones. In photo above, installation of these cyclones together with Model D10B primary cyclones for slime removal ahead of mechanical rake classifiers decreased the solution to ore ratio from 2.75 to 2.25 to 1 on an ore high in slimes. Although this arrangement of cyclones and rake classifiers is used primarily to improve solution ratio, this increases viscosity, but there is almost a complete rejection of the plus 10 micron sizes into the fine sands.

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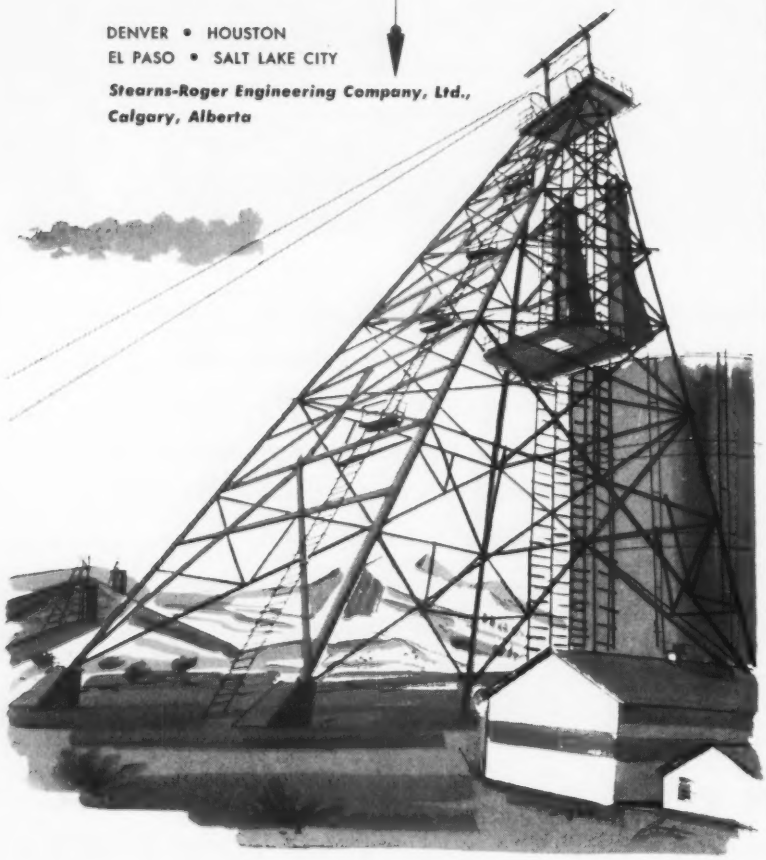

Ontario (*Continued*)

development at its gold producing property in the Kirkland Lake area. Production for the year was substantially above the previous year's $2,194,977, reflecting increase in milling rate from 386 to 450 tpd. Costs have been maintained at a low level.

Testing of the new 200-ton mill of Temagami Mining Co. is expected to start shortly at the company's copper property on Lake Temagami. The company has outlined 100,000 tons of ore grading 13% copper and is currently pursuing an aggressive underground exploration program.

The shaft has been deepened to 879 ft and two new levels at 675 and 825 ft are being opened up. During the fiscal year ended June 30, 1958, the company received $409,058 net smelter returns from shipment of 4,553 tons of development ore, bringing total returns since Aug. 15, 1955, to over $2.5-million.

QUEBEC

Cyprus Exploration Corp. in 1958 reportedly indicated 2.7-million tons, grading 2.25% copper, 3.92% zinc, 1.21 oz silver and 0.016 oz gold per ton, in diamond drilling on its optioned property in the Aylmer Lake area, Eastern Townships. Calculations are set on projection to 1,000 ft, deepest drilling being to 500-ft depth. The structure is said to be still open at depth and additional drilling is expected to be carried out during the current season. The property is held under option from Hastings Mining & Development Co.

Copper Rand Chibougamau Mines is constructing a mill of rated capacity of 1,500 tpd at its copper property in the Chibougamau area. The mill is expected to be in production by the last quarter of this year. The mill will also treat ore from the adjoining Chibougamau Jaculet Mines, which it controls, and development ore from the Portage Island (Chibougamau) Mines' property.

Hull Iron Mines has started shaft sinking at its iron property near Hull. A shaft is being put down from the 100-ft level to 480 ft with initial work scheduled on the 400-ft horizon. A 1,000-ft sloping tunnel was completed recently to open the Forsythe deposit where diamond drilling indicated an estimated 3-million tons grading around 44% iron to the 500-ft horizon. Headings have been driven at the 100, 150, and 200-ft horizons. Present thinking is that production operation will be around 1,000 tpd of high grade iron concentrate.

Portage Island (Chibougamau) Mines has four drill rigs in operation to probe the copper-gold zone discovered in drilling late last year on its property in the Chibougamau area. Drilling has already extended the zone to a known length of almost 1500 ft and will provide detail to depth. If results warrant, it is planned to sink a shaft to an initial depth of about 800 ft during the coming spring.

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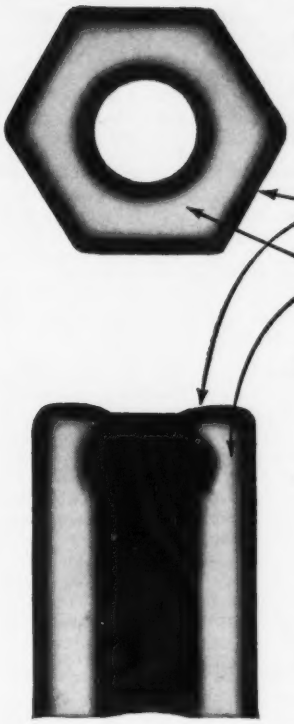

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Gardner-Denver sectional drill steel is carburized to produce the same hard case, soft core structure that produces superior rock drill parts. Shot-peening increases fatigue resistance.

High-tensile surface strength resists abrasion, corrosion, nicking and down-the-hole gaff.

Tough, soft core provides compressive strength to withstand shock loads without breaking.

Made from quality steel

Gardner-Denver uses special alloy steels to insure uniform hardening and longer service life.

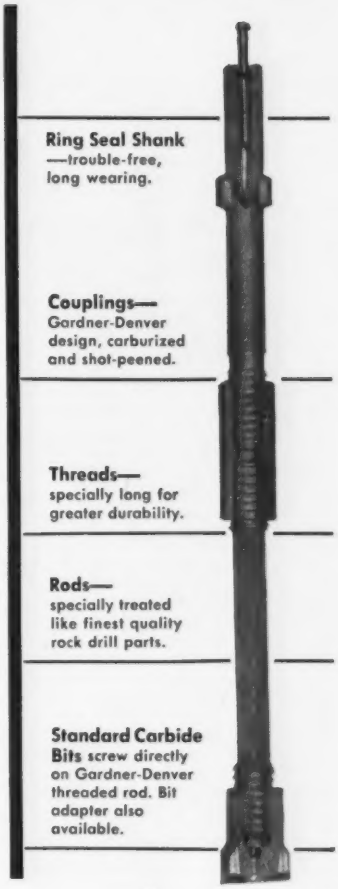
Threads and couplings designed for the job

The extra long threads and couplings of Gardner-Denver design provide greater strength and durability. Couplings are also carburized to provide a hard surface on the threads and a tough core.

Proved on the job

One user drilling hard rhyolite reports steel breakage reduced by 45% after changing over to Gardner-Denver drill steel.

Drill steel represents a large percentage of drilling costs. Gardner-Denver drill steel costs less to use. Write for information.


Ring Seal Shank
—trouble-free, long wearing.
Couplings—
Gardner-Denver design, carburized and shot-peened.
Threads—
specially long for greater durability.
Rods—
specially treated like finest quality rock drill parts.
Standard Carbide Bits screw directly on Gardner-Denver threaded rod. Bit adapter also available.

Gardner-Denver Sectional Drill Rod Specifications

	CL5-200 Series	CL5-400 Series	CL5-600 Series	CL5-700 Series	CL5-1000 Series
Thread Size	1 1/4"	1 1/4"	1 1/2"	1 3/4"	2 1/2"
Recommended Drill Size	3" and smaller	4" and smaller	4" and 4 1/2"	4" and 4 1/2"	5 1/2"
Recommended Bit Size	1 3/8" to 1 7/8"	2" to 2 1/4"	2 3/8" to 2 3/4"	3" to 4"	4", 4 1/2" and 5"
Rod Sizes	7/8" Hex.	1" Hex.	1 1/4" Hex.	1 1/4" and 1 1/2" Hex.	1 7/8" Hex.
Rod Lengths	2' to 20'	2' to 20'	2' to 20'	2' to 20'	4' to 20'
Coupling Diameter	1 7/16"	1 3/4"	2 1/8"	2 1/2"	3 3/8"
Ring Seal Shank	1" Hex. Collared 1 1/4" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/2" Round	2 1/2" Round

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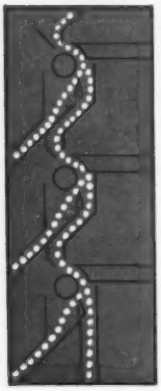

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For complete information, write to Stearns Magnetic Products, Dept. 800B-2.

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Quebec *(Continued)*

Campbell Chibougamau Mines is adding two more producing mines to its present two producers in the Chibougamau area. The major addition will be the Henderson near Portage Island where surface diamond drilling is said to have indicated over 3-million tons grading 2.66% copper and 0.08 oz gold to depth of 500 ft. Shaft to go to an initial depth of 700 ft is scheduled for completion by late August this year. The second operation will be the Kokko Creek at Dore Lake. This property, held under lease from Merrill Island Mining Corp., is being developed from the main underground workings on Merrill Island.

Marban Gold Mines is going ahead with shaft sinking at its gold property in the Malartic area. The shaft is being sunk to 685 ft with levels to be established at 200, 350, 500, and 650 ft. Initially 3,000 ft of lateral work will be completed on the two bottom levels. Plans are to ship ore to the mill of the adjoining Malartic Gold Fields.

Chibougamau Mining & Smelting has lined up diamond drilling programs for several of its properties in the northwest section of the province. Surveys are being done on some of these as well as surface prospecting. The company recently acquired claim groups in the Frotet Lake area, some 50 miles north of Chibougamau and these are included in the exploration program. Other properties include a large block of claims in the Mattagami area, claims in the Dore Lake area and in Scott and Levy Twps.

Mattagami Lake Mines, formed by the Mattagami Syndicate to take over its Watson Lake orebody in the Mattagami district, has added "substantially" to indicated tonnage and grade. Ore indicated in the main zone to Sept. 30, 1958, was estimated at 19,764,000 tons grading 12.73% zinc, 0.73% copper, 0.02 oz gold and 1.26 oz silver, an increase of 5.6-million tons over the previous estimate. Additional tonnage has been added since that time.

MANITOBA

Rash-Mac Explorations report encouraging gold values obtained in the diamond drilling of its 27 claim prospect near Twin Lakes, 20 miles southeast of Flin Flon. Further surface exploration and drilling have been recommended.

Central Manitoba Mine advised shareholders at its annual meeting that further diamond drilling is planned on the Agassiz Mines in northern Manitoba. Previous drilling indicated interesting values in gold and silver.

Cove Uranium Mines investigated an anomaly outlined on its holdings near Blueberry Lake in Northern Manitoba. Copper values were obtained from surface samples. The company is retaining its holdings in the Cuthbert Lake area, and a lithium prospect at Bernic Lake

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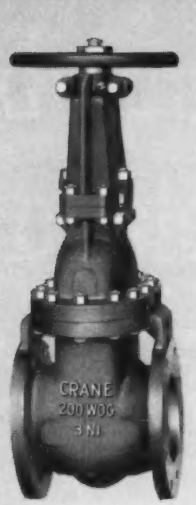

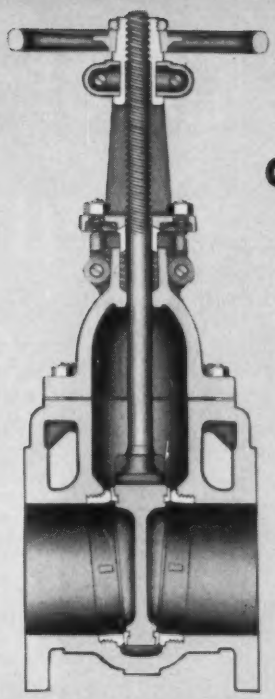

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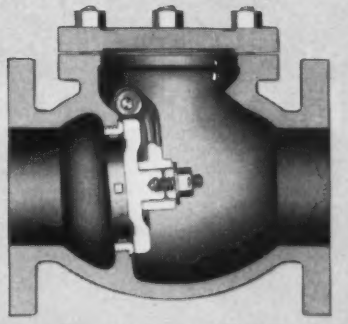
18-8 SMo (Type 316) Alloy Trimmed



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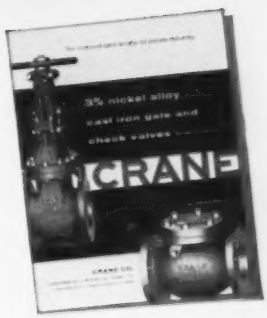

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Manitoba *(Continued)*

and molybdenite prospect at Athapapuskow Lake.

Keystone Mines & Oils plans to carry out a diamond drill program on its 38 claim property near Wallace Lake in Central Manitoba. A geological and geophysical program was completed last summer.

BRITISH COLUMBIA

B. C. Mines Minister Kenneth Kiernan has announced that estimated value of mining production in B. C. this year is reduced 14% from 1957.

Values for 1958 are expected to reach $149-million as compared to $172,264,617 last year.

Gold is down $1-million and silver is up $273,000. Copper is down to $3,350,000 as compared to $7,631,897. Lead production dropped from $39,568,086 to $32,675,000 and zinc dropped from $50,225,881 to $45,550,000.

Here are the estimated values of production of some leading metals, with 1957 figures in brackets:

Totals $149-million ($172,264,617); gold, lode and placer, $6,575,000 ($7,546,066); silver, $7,350,000 ($7,077,708); copper, $3,350,000 ($7,631,897); lead, $32,675,000 ($39,568,086); zinc, $43,550,000 ($50,225,881); iron, tungsten and nickel, $6,475,000 ($7,441,116).

Minister Kiernan also said in Vancouver that the B. C. government is acting only as "umpire" in the Wenner-Gren development of the Rocky Mountain Trench.

"We are entering into contracts for the benefit of the people, and we shall try to see that fair rules are applied to one and all." He added that the cost of the venture would triple B. C.'s contingent liability.

The Yale Lead & Zinc Co. mine at Ainsworth has closed down because of poor market conditions and falling ore production. It has been producing steadily for eight years. The company's mill at Ainsworth will continue to operate, doing custom milling and employing about half a dozen men.

A merger is planned enabling Bralorne Mines Ltd. to take over and operate Pioneer Gold Mines Ltd. it was announced by Franc R. Joubin, president of Bralorne, and Hon. Frank Ross, president of Pioneer.

An uncertain picture regarding ore reserves was noted in the last annual report of Pioneer and this is understood to be a factor in the planned merger. The mines operate adjoining properties in the Bridge River country.

Shareholders of Pioneer will receive one share of Bralorne for each five Pioneer they hold. It is understood the 400-ton Pioneer mill will be kept operating.

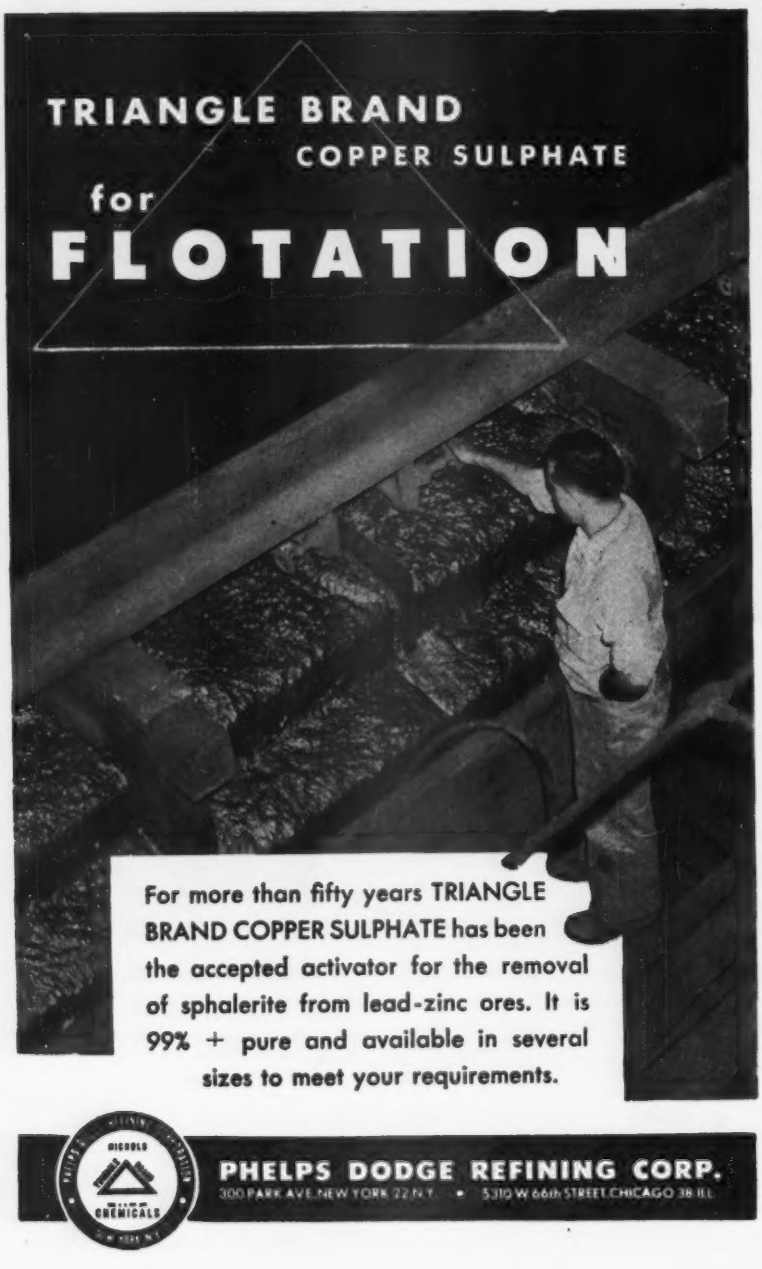
A merger of the two companies has been rumored for some time and is part of the reorganization begun by Joubin since he became president of Bralorne in August.

Joubin, who became famous as discoverer of the Blind River uranium field in Ontario, started his career with Pioneer as a junior geologist in 1937. From 1943 to 1948 he was in charge of Pioneer's eastern Canadian exploration, then became an independent geologist.

Both Bralorne and Pioneer were staked in 1897. Pioneer has paid more than $10-million in dividends and Bralorne more than $17-million. Pioneer got into production in 1900, grew to a 100-ton mill in 1928 and a 400-ton mill in 1934.

Bralorne was started in the early 1930's by Austin C. Taylor, who resigned last year. Bralorne directors just appointed are Karl Springer, Canadian mining executive, and Paul Westerfield, Cincinnati, Ohio, banker.

Granby Consolidated Mining, Smelting & Power Co. Ltd. plans a major reorganization, change of name and increase in authorized shares to prepare for future opportunities and expansion. Proposed new name is Granby Mining Co. Ltd. The modernization plan was announced by president L. T. Postle who explained the company now operates under an antiquated act of Parliament which imposes severe restrictions. Approval of shareholders will be sought at an early meeting to correct this situa-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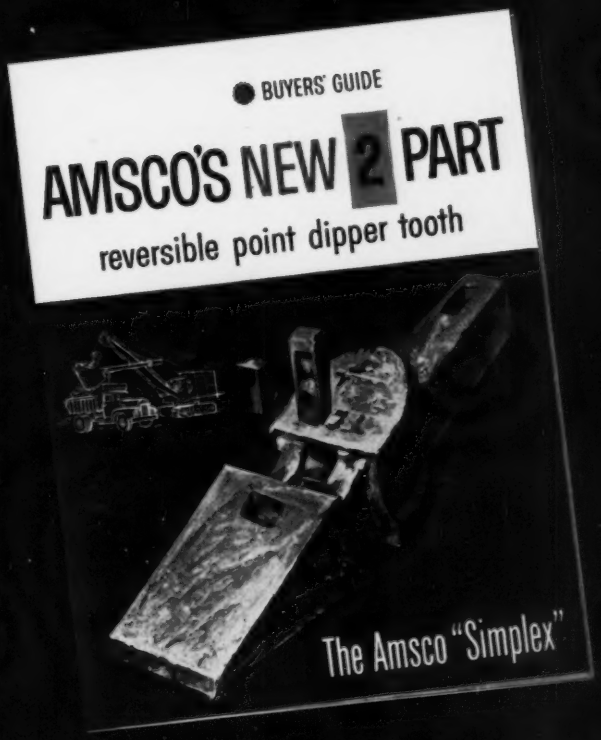

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B.C. *(Continued)*

tion by submitting a private bill to the B.C. Legislature at the coming session. The bill would change the corporate structure of the company. New by-laws have been drawn up.

Postle said the changes are intended "to modernize the company's corporate structure, to remove unneeded restrictions and to allow greater scope for the company's development."

Privateer Mine Ltd. is in the process of reorganization following a meeting in which the directors proposed to reduce the number of authorized shares from 3 million to 600,000 by giving one share in a new company, to be called New Privateer Mine Ltd., for each five old shares. They then want to increase the number of authorized shares to 3-million without nominal or par value.

Dr. E. K. Pinkerton, president, said the situation points the way to a profitable revival of the former gold producer's activities, and that after the reorganization, the management intends to arrange a share underwriting sufficient to satisfy the loans from shareholders and to carry on preliminary work on its Zeballos gold and copper properties.

During a 10-year period Privateer produced ore with a gross value of $6.2-million and paid $1,914,182 in dividends. Dr. Pinkerton said that ultimately "it may be advisable and fruitful to undertake a deep development program."

Tofina Mines Ltd. reports its property on Vancouver Island is showing favorable depth results. Values of the narrow high grade gold-bearing vein at the 1500-ft level have proven similar to those above. The ore has an estimated concentration of about 20 tons per vertical foot averaging 1.85 oz gold a ton before allowing for dilution. This vein has been traced on the surface for about 4800 ft. Average width of the oreshoots is about one foot.

Nine vertical holes are drilled by Torwest Resources Ltd. on target area No. 1 of its Swakum Mountain property, 20 miles northeast of Merritt. The first hole ran out of ore after cutting a length of 23 ft assaying 2.35% copper. Visible precious metal content has not yet been assayed. It is hoped to have a second drill working shortly. W. E. Garnett has been elected president.

Trojan Consolidated Mines has signed a deal in which Newmont Mining Corp. will explore and develop its Highland Valley property. George L. Conn, president of Trojan said Newmont acquires 70% interest in the property and Trojan keeps the balance.

"All exploration and development expense will be financed by Newmont and such work will be under Newmont's direction and management," Conn said.

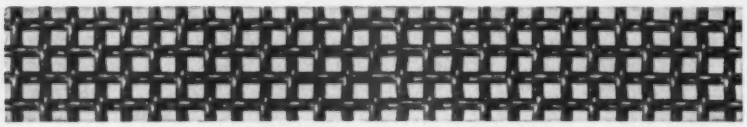
A diamond drilling program will start early in the year and future plans will depend on the results. Encouraging reports have been received from geophysical and geological surveys done on the claims earlier.

Trojan has also acquired 20 claims in the Merritt district within two miles of Craigmont's property and a geophysical survey is to be done on them as soon as conditions permit.

J. R. Piper, president of Sheep Creek Mines Ltd. reports the company has taken an option on all shares of Venturas Mineras de Mexico S.A. The option provides for an aggregate purchase price of $375,000 (U.S.) and $25,000 is to be spent by Sheep Creek for exploration on the property during the first six months of the option. If the option remains in force Sheep Creek is to make a further advance of $25,000 to Venturas to pay certain debts.

Sheep Creek will have the right to make further advances at its discretion and provision is made for the company to be reimbursed for its advances out of production if the option is fully exercised. The property is known as La Reforma Mine and is in the El Fuerte district in Mexico. So far only shallow surface work has been done and an engineer's report states that the main deposit has been exposed for a length of 1300 ft, depth of 450 ft and widths from 30 to 90 ft. Assay values of crude ore shipped show, for 7,500 tons: 9.4 oz silver; 8.1% lead; 20% zinc; 1.4% copper. Diamond drilling started under contract Nov. 23.

For the six months ended Nov. 30,



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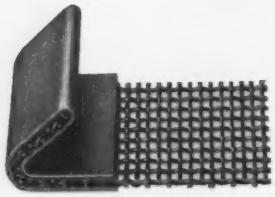

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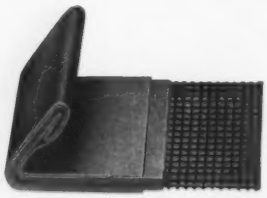

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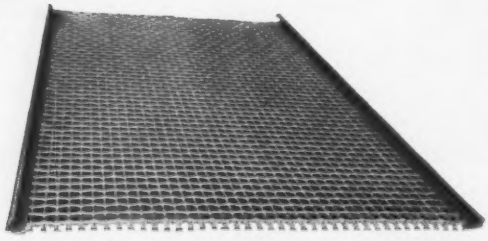

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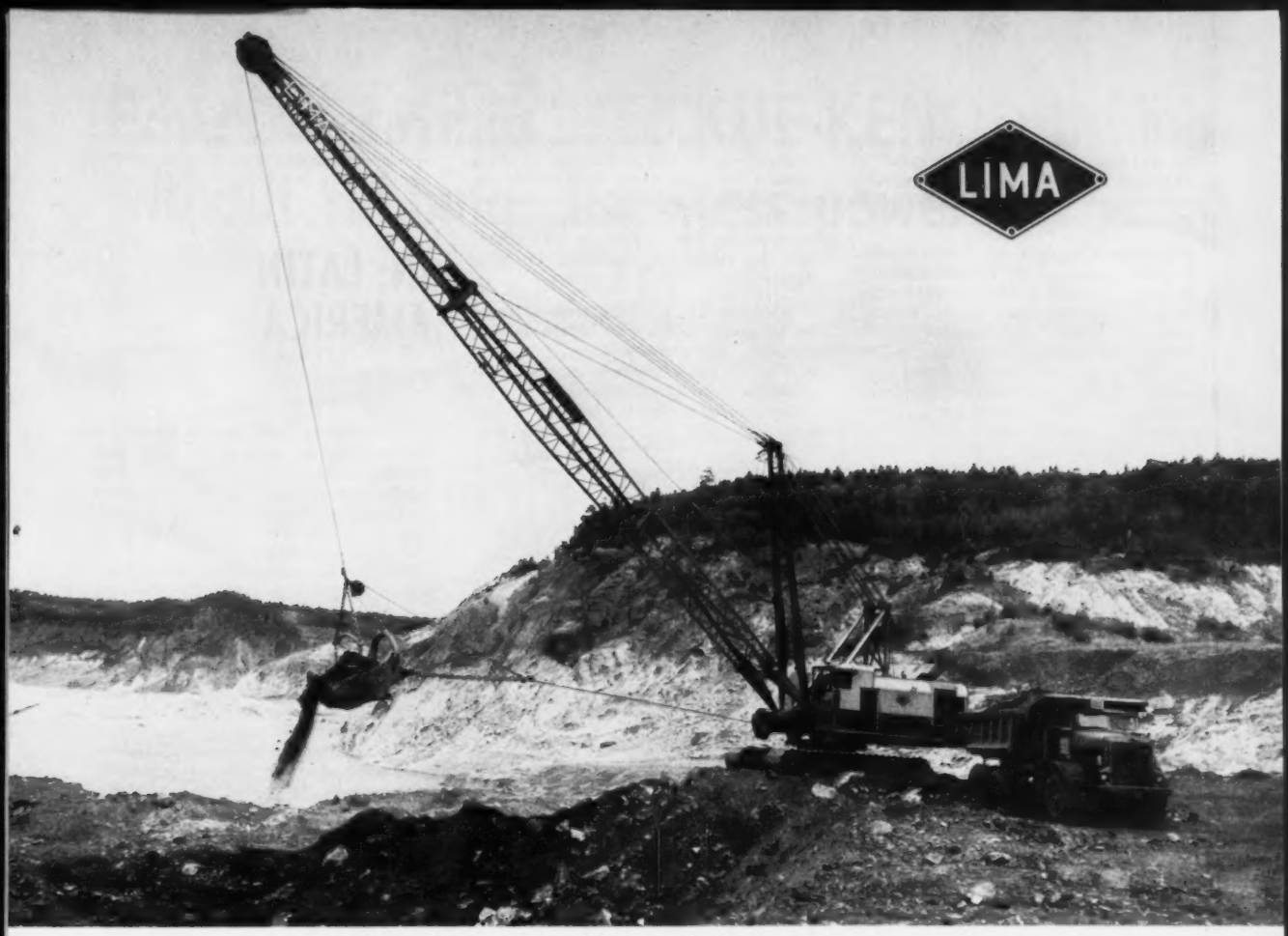

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B.C. *(Continued)*

Sheep Creek reports an operating profit of $81,090 from a smelter value of $519,546 in lead and zinc. Operating expenses totalled $438,455 and capital expenditure was $12,661.

Bethlehem Copper Corp. has completed the first phase of its current $900,000 program and will go into the next phase early in the new year. H. H. Huestis, president, reports that the 4600-ft elevation adit, started last July, entered the western fringe of the Jersey orebody at about 2700 ft from the portal and contract has been let for a further 1,000 ft of underground work. This will extend the tunnel to the East Jersey zone.

By next fall when the program is expected to be completed, the company expects to have exact information on the average copper content of the two orebodies. A bulk sampling plant capable of handling from 25 to 35 tons hourly will be ready for operation by mid-January.

Changes in B.C.'s mining laws, expected to be more "attractive" to the mining industry, are planned for the coming session of the Legislature according to unofficial word in mining circles.

Reaction of the mining industry against drastic changes in legislation introduced early in 1958 (Elimination of Crown grant lands and taxing of ore in the ground) has been so vigorous, that the government would seem to have adopted a much more conciliatory attitude.

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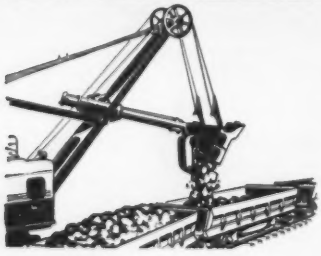

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IN LATIN AMERICA

CHILE

A referendum has been signed in Santiago for the sale of the large iron deposit of "El Laco" between the owner of the property and Cia. Minera Santa Fe which is exploiting several medium sized iron deposits in the provinces of Coquimbo and Atacama.

El Laco is located 108 miles from the village of San Pedro de Atacama and very near the Argentine border at 15,000 ft above sea level. The whole of the deposit is said to consist of three distinct orebodies known as Laco Grande, San Vicente and Laco Chico which contain at least 110-million tons of high grade iron ore. To exploit the mine it will be necessary to construct a railroad from the deposit to the port of Antofagasta where the ore will be loaded for shipment abroad. Preliminary surveys for the railroad will be started next January as well as the drilling of the deposit to determine tonnage and grade. A contract has been signed between Bethlehem Steel and Cia. Minera Santa Fe for the former to buy the ore from the latter which is owned by the shipping firm of Isbrandtsen.

Mitsubishi Mining Co. and Mitsubishi Trading Co. have made an arrangement to jointly mine the iron deposit of Las Adrianitas north of the town of Copiapo, Atacama province. To exploit the mine a capital of U.S. $277,777 will be invested. The deposit has been diamond drilled and contains about 10-million tons of 65% iron ore which will be bought by Yawata Iron and Steel Co. For the shipping of the iron ore to Japan a special company will be formed by six Japanese firms.

Señor Fernando Varas has been nominated by the new Administration as executive vice president of the Copper Department. Señor Varas was formerly chief counsel for the Mining Credit Bank during 15 years and is a professor of International Law at the University of Chile and a very distinguished Chilean counsel. His nomination for the important post has been very well received in mining circles where Señor Varas is well known.

The new Administration just inaugurated has nominated a Special Committee to inquire into the organization of the Mining Credit Bank and the National Smelters Corp. In Chile there are at present 10 different government organizations and agencies to deal with the Mining Industry.

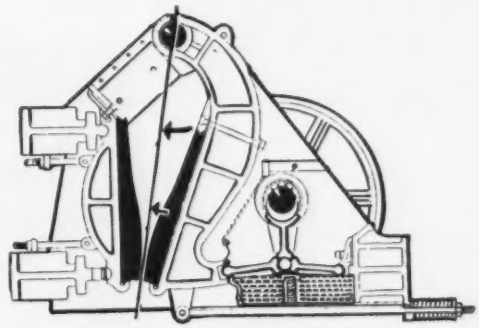
Powerful savings . . . KUE-KEN® "crushing without rubbing" uses less power

Here is a table of tons per hour that will pass through crusher with jaws set at dimensions shown when measured in the closed position.

Kue-Ken crusher size	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"	Horsepower range
24" x 12"	22	26	32	36	43	50	56					15 to 30
30" x 12"	32	35	38	42	55	70	76	85	110			20 to 30
36" x 10"	38	47	57	67	80	91	105					25 to 40
36" x 20"					70	82	90	115	135	160		30 to 50
42" x 25"					90	120	150	165	180	215	250	40 to 60

Table is based on crushing average hard dry quartz or similar rock weighing at least 100 lbs. per cubic foot when crushed. 32 sizes available from 12" x 5" to 48" x 42".

In Kue-Ken, power is used to crush rock not to wear out jaw plates. By gripping rock firmly, crushing squarely and eliminating rubbing, Kue-Ken produces far more tons per hour at any given horsepower as shown in chart above. Kue-Ken jaw plates last at least 5 times longer . . . especially important with hard-rock crushing. Kue-Ken mechanism operates in a sealed, dust-tight crankcase lubricated by filtered oil to permit higher speed for greater capacity and a more uniform product. Wear is negligible and shutdowns common to conventional crushers are practically eliminated. Automatic flywheel release prevents breakage from tramp iron. Kue-Ken crushes at the lowest cost per ton. There is a size to meet every need.



See how the hinge pin is located on the center line of the crushing zone. The jaw moves in an almost straight line. Rock is instantly gripped and crushed without rubbing.

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IN AUSTRALIA

A slow but definite improvement in the overseas demand for Australian rutile is confidently envisaged by Australian producers. It is now thought that the second part of 1959 may already show some improvement in demand but not in prices and that 1960 and 1961 will be definitely better years for mineral sands producers. In the meantime, several Australian producers report a reduction in production costs and claim that even at present depressed prices they are able to make a small profit.

The State Government of Victoria will assist approved drilling projects aiming at discoveries of new orebodies by paying up to 50% of the costs. Gold mining companies are likely to be the principal beneficiaries of the new policy.

United Uranium N. L. will begin uranium oxide production early in March 1959 and will start deliveries to the U.K. Atomic Energy Authority about two months later. 1959 exports should be worth about $1-million but would be doubled in the next year. At the El Sharana mine, the open-cut has produced 12,000 tons of ore assaying 11 lb of uranium oxide a ton. At the Palette mine, underground development has exposed pitchblende ore shoots over 330 ft of which 200 ft were in payable ore. At the Scinto-6 orebody, promising results are also being obtained.

The official Australian Bureau of Mineral Resources expects that present world surplus production capacity of lead and zinc will continue for some time but that surplus copper output will be of relatively short duration. The Bureau places Australia as the world's leading producer of lead, third ranking producer of zinc and a prospective important producer of copper.

In a preliminary estimate for 1958, the Bureau placed the Australian copper output at 65,000 tons, well above the 1957 figure. Increases of lead output at Mt. Isa Mines (controlled by Asarco) and production cuts at Broken Hill will give a total mine production of 310,000 tons. Mt. Isa would produce about 55,000 tons of bullion and refined lead production at Port Pirie is estimated at 185,000 tons. Exports had continued at a good level but U.S. quota restrictions would mean that 1959 exports to the U.S. would be about one half of the 1957 volume.

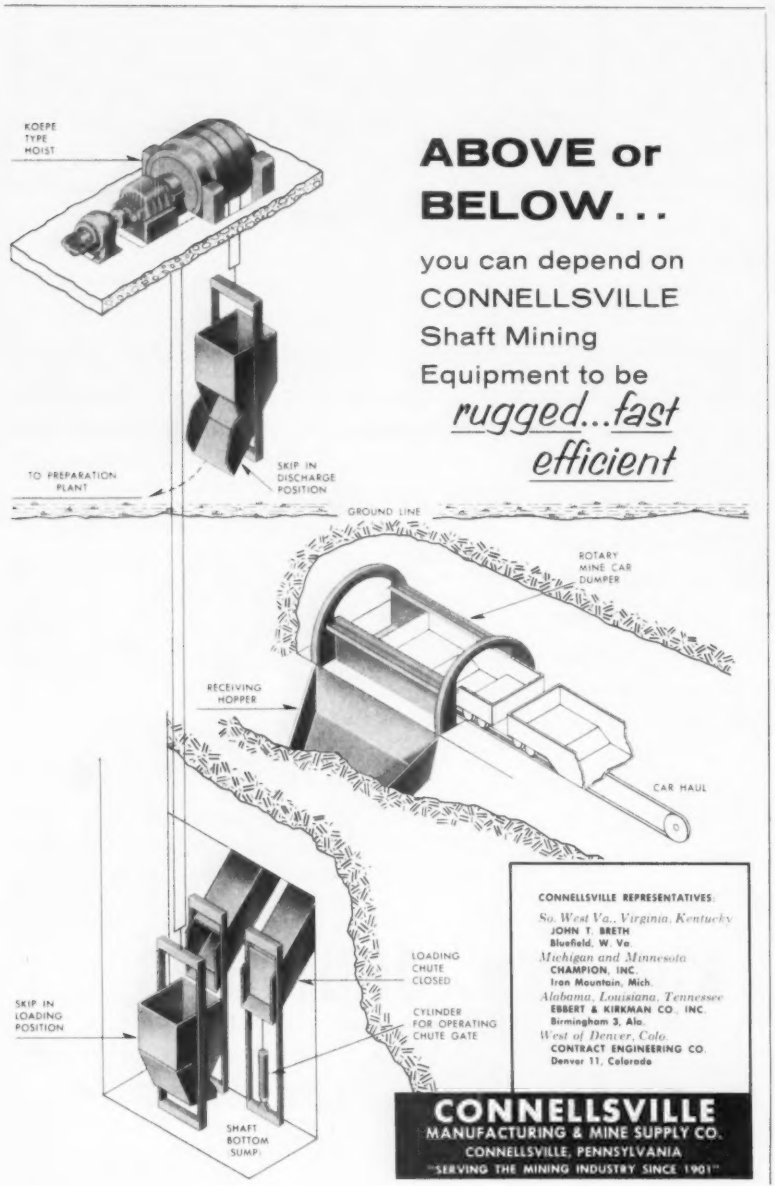
Mine production of zinc will be lower than last year; about 270,000 tons, but refined zinc production will rise to 115,000 tons. Rutile and zircon output fell considerably from 1957 figures with estimates for 1958 at 80,000 tons for rutile and 55,000 tons for zircon. Overseas demand is now improving. Tungsten had a poor year with output of about 1,300 tons while tin production improved to 2,100 tons. Uranium production also increased with the start of operations at Mary Kathleen.

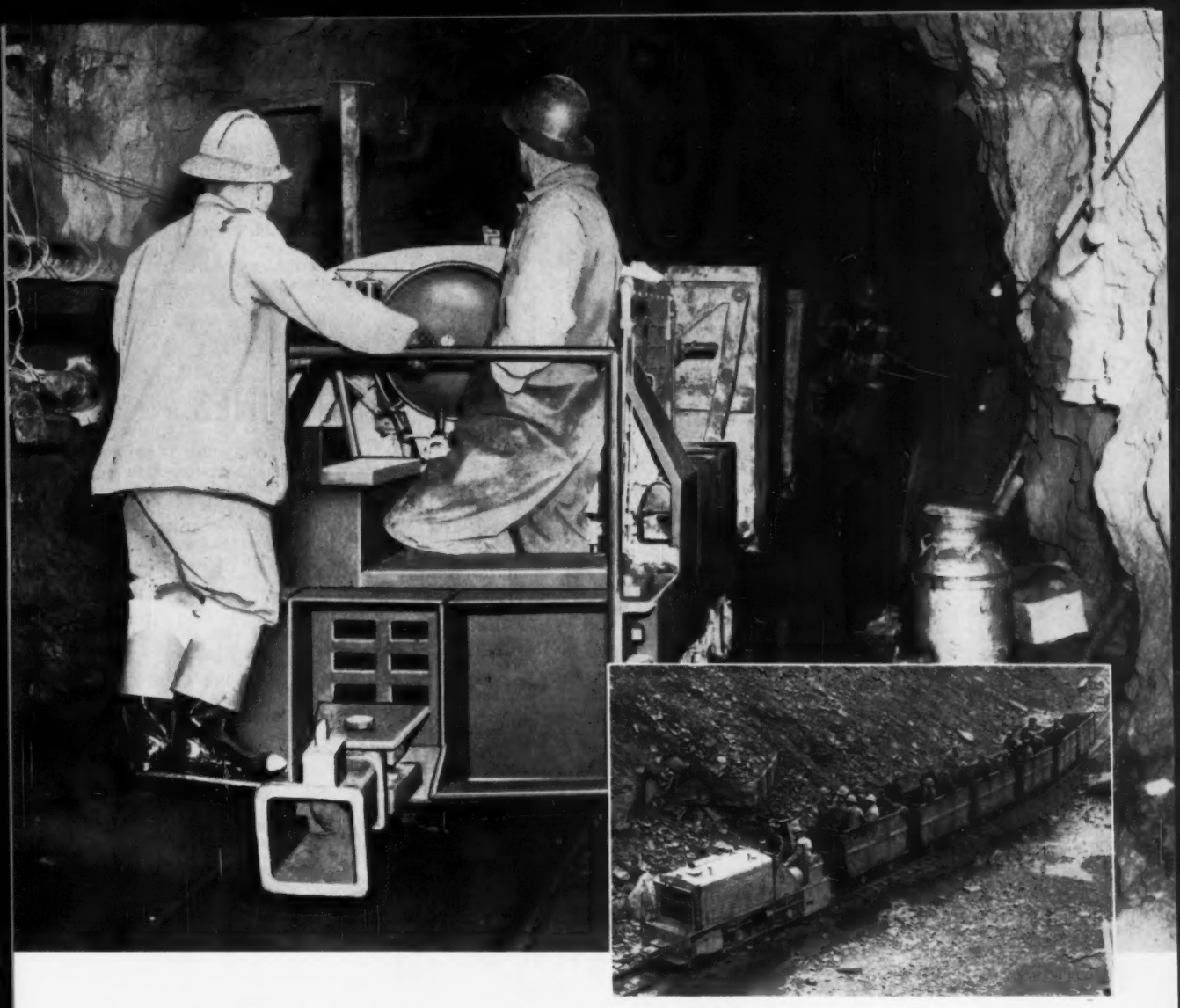
Prospects of Australian-controlled Fiji gold producer Emperor Gold Mining Co. Ltd. have been described as brighter than for several years. Development results have been so good that the company has decided on a three-year program to increase production and step up exploration. $350,000 will be spent on modernization and extension of the treatment plant to raise throughput to 200,000 tons a year. Large cost savings are expected.

Mt. Isa Mine's blister output in 1959 increased so much that the copper smelter no longer possesses smelting capacity in excess of mill concentrate production. Among important modifications in the copper smelter was the installation of larger and faster cranes and the addition of a second turbo blower air main which allows two converters to be blown independently of each other.

Australian Gold Development N. L. reports that prospecting and testing of the Kainantu areas in New Guinea has proved a large orebody carrying gold values of very promising nature. An expanded development program is being arranged and new capital is being called up.

Mt. Harris Tin Mines N. L. reports that the check sampling of the Jessop lode shows an average width of 3 ft 8 in. and an average grade of 2.45% tin. The latest





PLYMOUTH Mine-O-Motives help set new records at West Delaware Tunnel

A fleet of 17 Plymouth Mine-O-Motives, employed by joint venture contractors Drake-Grafe-Winston-Tecon-Conduit under Project Manager Clancey O'Dell, have helped to establish new hard-rock tunneling records of as high as 85 feet per day on the West Delaware Tunnel near Cannonsville, New York. Working around the clock since the summer of 1956, these Diesel-powered mine locomotives have seen the most rugged service imaginable for mechanical equipment. Rough trackage, deep water, heavy loads of rock waste, all on a 24 hour schedule to push this 45 mile long tunnel deep through the Catskills for additional water to the New York City water system.

Used from the west portal and from several shafts on the western end of the tunnel, these 10 and 15 ton Diesel locomotives have proven their ruggedness and suitability for tunneling work. Plymouth exhaust conditioning equipment has maintained tunnel air at a high degree of purity. Easy accessibility of all parts speeds maintenance, keeps down time to a minimum. Torque-converter drive cushions shock loads, speeds up production, provides maximum power, and reduces operator fatigue.

For full information on Plymouth Mine-O-Motives and Locomotives, tailored to your exact haulage needs, contact The Plymouth Locomotive Works, Division of The Fate-Root-Heath Company, Dept. A-22, Plymouth, Ohio.

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Basic kit includes drill, pump, and accessories. Rods and bits additional.

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This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

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Australia *(Continued)*

average assay is considerably lower than previous estimates. Work on the leases cannot be resumed until the end of the wet season.

Westralian Oil Ltd. is erecting its treatment plant for mineral beach sands with a maximum capacity of 100,000 tons a year. High grade ilmenite and leucoxene will be produced and the company hopes that the high quality would enable it to compete in the market.

PHILIPPINES

Lepanto Consolidated milled 39,000 tons of ore in November, averaging 1350 tpd, a new record. Average copper content of the ore was 3.2%, with 0.133 oz gold per ton. The concentrates recovered averaged 28.3% copper and are estimated to contain 2,400,700 lb of copper and 3920 oz of gold. Copper recovery was 95.5%, and gold 75.5%. The company resumed dividend payments in the final quarter of the year after omitting payments in the two preceding quarters.

Atlas Consolidated milled 344,290 tons of ore in November. Copper content of ore milled was 0.66%, slightly lower than in October. The month's production is estimated to have contained 3.8-million lb copper and 900 oz gold. Concentrates averaged 26.4% copper. All were shipped to Japan. The mill operated 27½ days. Total value of copper shipments in November was $1,264,000. In addition, the Mati iron mine in Davao made two shipments totalling 13,500 tons, valued at $196,800.

Surigao Consolidated continues to be the principal gold producer in Mindanao. The mill operated in November at over 400 tpd and recovered 3193 oz of gold, 4315 oz of silver and 64 tons of lead. Recovery of lead as a by-product is unusual among Philippine gold mines. The total production value is placed in excess of $241,000, which takes in effect the subsidized gold price in Manila.

Marsman & Co., managers of the Itogon-Suyoc properties in Baguo, have announced that rehabilitation of the caved-in tunnels in the old Suyoc mine, a prominent prewar gold producer is progressing favorably. Installation of mill machinery and equipment is over half completed. At the Itogon mine about 600 tpd are being milled, averaging about 0.14 oz of gold per ton. Thanks to the gold subsidy, this ore is valued about $9.15 per ton instead of $4.90 at the statutory price.

Samar Mining Co. is continuing its development program on its iron ore property in Zamboanga. A 38-km road is being built to connect the mine with tidewater where a pier and stockpile will be constructed for all year loading of ore. About 27 km of the road have been graded and surfaced and completion is expected early in 1959.

Marinduque Iron Mines had a produc-

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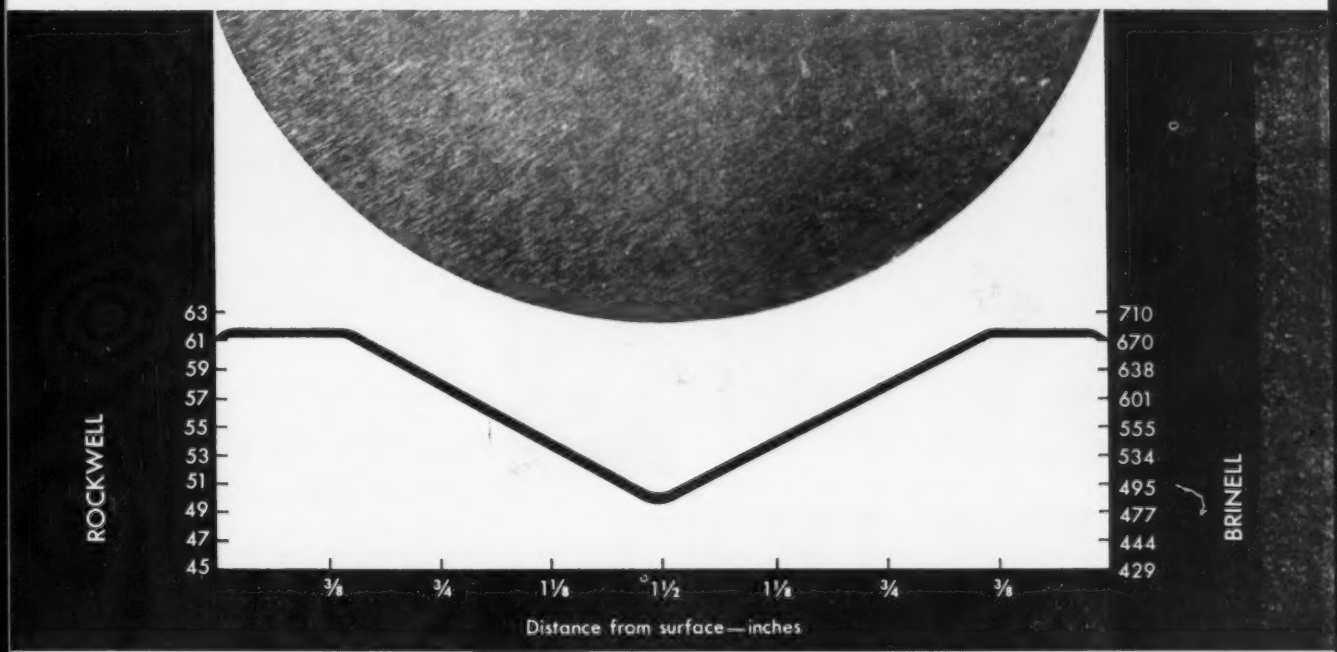

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Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

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Philippines *(Continued)*

tion valued at over $900,000 in November from the company's mines in Samar, Negros, and Marinduque. The Bagacay copper property shipped 4000 tons of copper ore valued at $370,000, a record high. At the Sipalay mine 128,800 tons were milled during the month, estimated to contain 1.6-million lb of copper. From Marinduque 3242 tons of iron ore were produced with an approximate f.o.b. value of $29,000. All shipments went to Japan.

IN AFRICA

The South African gold mining industry reached a new peak of achievement in 1958, with all-time record figures for quantity and the value of its product. Statistics released by the Chamber of Mines include:

The industry produced 17,665,739 fine oz last year—635,002 oz more than in 1957 when the previous best was recorded.

Monthly figures for 1958 consistently outstripped the comparable figures for the previous year as the newer mines in the Orange Free State and in the Transvaal in fields west and east of the Rand increased production.

Monthly output in 1958 climbed in an almost unbroken curve, starting with a figure of 1,418,039 oz in January and reaching a high point—a record for the industry—of 1,560,726 oz in October.

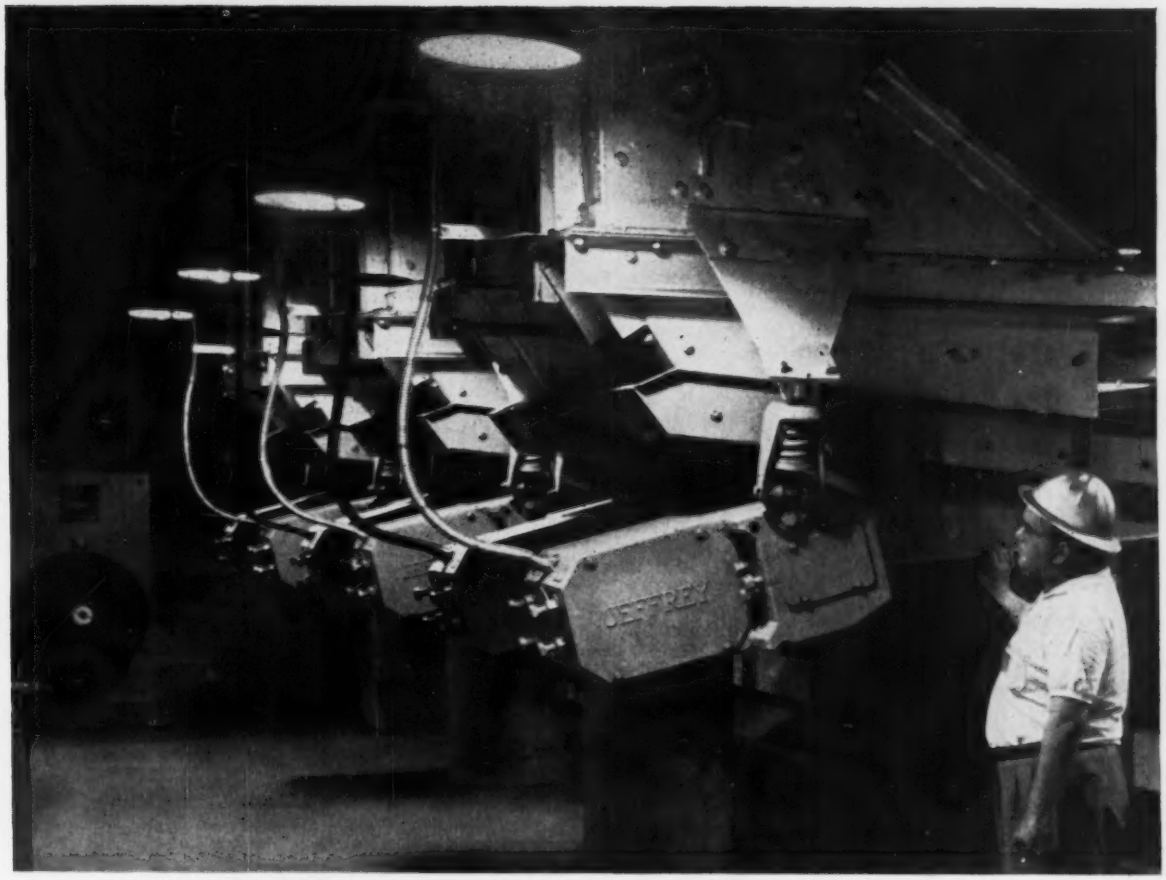
The supply of labor to the mines was generally maintained last year. The number of negroes employed by the large producers who are members of the Witwatersrand Native Labour Association was 329,234 at the year end—an increase of about 20,000 over the figure at the end of December, 1957.

Rising output in the Free State and other fields will continue to cover the gradual fall-off in production from the older workings on the Rand.

Total value of production of minerals in Northern Rhodesia for the first eight months of 1958 was $154,749,000 compared with a figure of $195,229,800 for the corresponding period of 1957. Copper, the territory's most valuable product, improved in production. Blister copper was up by about 150 tons but electrolytic copper improved by about 22,500 tons. A significant fall in export prices accounted for the lower price yield.

An enormous reserve of kaolin of exceptionally good quality has been found at Bitterfontein in the Cape Province. The exploitation of this and other deposits should make the Union completely self-sufficient. There is also a strong demand from Germany for this product as an alternative to difficult sources of supply behind the Iron Curtain.

Free State Geduld, one of the new Orange Free State mines, will drive towards the Geduld No. 1 borehole on two levels this year, says an official statement. In view of the footage to be



324 of these Type 4DTH feeders draw minus ¾" ore from surge bins, regulate 2,700 ton/hr. flow to 27 rod mills.

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Jeffrey feeders measure out 45 tons of Taconite every minute!

At this huge $300 million dollar plant, 372 Jeffrey vibrating feeders regulate the flow of flint-hard taconite to crushers and rod mills. Ore is crushed, separated and pelletized on a 24-hour, 365 days-per-year basis. Annual raw ore consumption is a staggering 22,500,000 tons.

Although the Jeffrey feeders at this plant are specially engineered, they are adaptations of standard designs, perfected through more than 25 years' experience in dealing with over 300 different solid materials.

Use Jeffrey's long experience and proved line of vibrating feeder equipment as an economic solution to your solid material handling problems. Write for Catalog 930—describes in detail the complete line of Jeffrey vibrating equipment, gives specific technical data, shows hundreds of applications.

Jeffrey vibrating equipment feeds, conveys, cools, drys, packs, screens, weighs solid materials roughly fitting these requirements:

Capacity	A few ounces to 2000 tons/hr.
Size	One micron to four-foot cubes
Density	4 lbs/cu. ft. to 400 lbs/cu. ft.
Moisture	Dripping wet to bone dry
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Hardness	From wood flour and peat to abrasive grains and glass cullet

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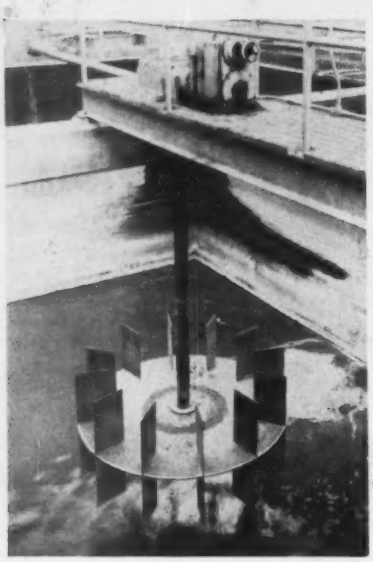

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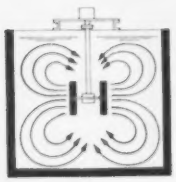

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dispersers for gas absorption

Speed alone will not insure complete mixing—unnecessary speed wastes power. Power requirements vary directly as the quantity of liquid pumped and as the cube of the mixer speed.

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The "VORTI-FLOC" unit accomplishes self-coagulation. The gentle flow and turbulence in the liquid creates repeated particle contact which results in particle growth. No underwater bearings are necessary in the "VORTI" and "VORTI-FLOC" units, except in unusually deep tanks.

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Africa *(Continued)*

driven, however, some time may elapse before development reaches the immediate vicinity of the borehole.

Exploration has revealed areas of promise which should add substantially to the ore reserves and increase the estimated grade of the ore blocked out at No. 1 shaft.

Work has started on a scheme to reclaim the lower portion of No. 2 shaft which was sealed off when water rushed into the shaft in 1953. The reclamation scheme will enable further areas to the north and south of the shaft to be opened up.

The full benefit of an expansion in the milling program at the President Brand mine (Free State) is expected to occur in the latter half of 1962 according to the annual report presented last month. It is expected that the milling rate will be maintained at 100,000 tons a month during the current year.

The considerably higher values disclosed in Borehole SP 6, sunk 2,650 ft east of No. 2 Shaft, encourages hopes that the zone of high values encountered at No. 1. Shaft may extend farther to the south-east than was originally expected and that this locality of the mine will prove of higher value than previously estimated.

As a result of surface waste sorting of 12%, the gold recovery rate has been maintained at 14.89 dwt a ton at little cost compared with 15.21 dwt a ton in 1957, despite the larger tonnages of lower grade ore drawn from No. 2 Shaft.

The milling rate at the Winkelhaak gold mine, the first gold mine to be established in the new Kinross field of the Eastern Transvaal Highveld, is substantially greater than predicted. It was expected that a figure of 60,000 tons a month would only be reached by about May of this year. However, the initial milling rate started a few months ago is 69,000 tons. It seems that underground development has been proceeding at a greater rate and that stopes are becoming available earlier than expected.

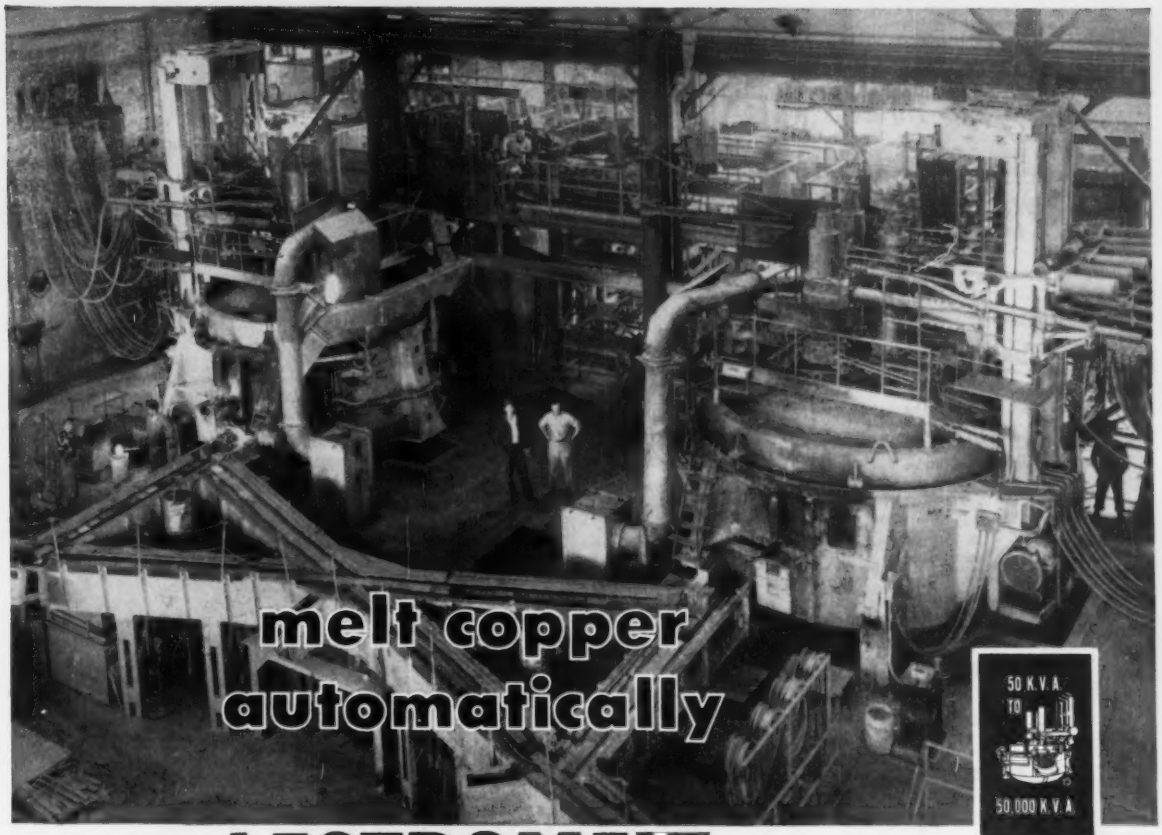
The rise in the gold recovery made at the Welkom mine in the Orange Free State last year was achieved by increasing waste sorting from 0.9% to an average of 7.17%, says the chairman's statement accompanying the annual accounts. The increase in recovery is given at 0.72 dwt a ton.

The increase in the milling rate planned for the future involves opening up further areas. Surface waste sorting will be maintained in future at approximately 12%.

No. 1. Shaft will reach its final depth during this year, making possible development on the lower levels to the east of the shaft.

Mining of emeralds from the Belingwe claims in Southern Rhodesia was due to start about the New Year, according to the partners, C. J. Oosthuizen and L. J. Contat. They added that the field would start producing on a pilot scale.

The emerald field—situated in the



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prove economical in continuous cycle operation

Refined copper can be melted and cast in a continuous cycle with Lectromelt furnaces—they're especially suited to automatic operation. Certain casting cycle stages are eliminated and time required for others is reduced. High quality is maintained at reasonable cost.

Data obtained on Lectromelt furnaces operating in United States, Canada, South America, Sweden and South Africa disclose these facts: Continuous flow of copper contains an average of only .01% oxygen because of excellent control of furnace atmosphere. Sulphur and iron contamination is prevented by (1) thoroughly cleaning cathodes prior to melting, (2) heating by direct-arc, (3) using high-grade refractories.

Cost of furnace operation is low. Power consumption varies between 200 kwh and 300 kwh per ton. Electrode consumption averages 3 to 4 pounds per ton. Maintenance is minimized to about one hour per week.

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One of ten Nagle 2" type "QW-B," vertical shaft, centrifugal pumps is pictured recirculating spillage to a concentrator at the Paragsha Copper Concentrating Plant of Cerro de Pasco Corp., in Peru. Pump is suspended from chain hoist between guide rails for easy raising and lowering. Fifteen Nagle pumps used at this plant.

The "QW-B" is a wet pit pump with shaft bearings enclosed in a quill. It is as efficient, foolproof and free of maintenance as a pump can be —a good pump to have when you're far from the source of supply. Like all Nagle Pumps, the "QW-B" is designed for abusive service—to handle abrasive or corrosive mixtures, slurries, hot liquids. There's a Nagle horizontal shaft or vertical shaft pump for every abusive pumping job. Ask for Catalog 5206.

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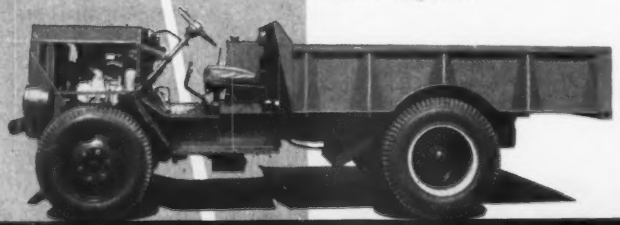

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Africa *(Continued)*

Sandawana among the Mweza Hills in the territory—has been valued at $14-million by mining experts. The partners emphasize that they will work the claim themselves—even when it is in full production.

Because beryllium may be used in Britain's next series of advanced gas-cooled reactors, the United Kingdom Atomic Energy Authority is intensifying its investigation of beryl deposits in Southern Rhodesia, and has substantially increased the staff of its office in Salisbury.

The Authority is carrying out an aerial survey of radioactive deposits in Southern Rhodesia and has lent scintillation counters to a number of the large mining companies in the Federation of Rhodesia and Nyasaland.

In the past year two important radioactive mineral discoveries have been made in Southern Rhodesia, one at Wankie in the western part of the Colony and one at Sebungwe in the south.

The aged ERPM gold mine at Boksburg, east of Johannesburg, is to be rejuvenated. Plans to exploit the ultra-deep sections of the property are to be followed through and the obsolete reduction plants are to be replaced with a central modern unit designed to reduce costs and increase efficiency.

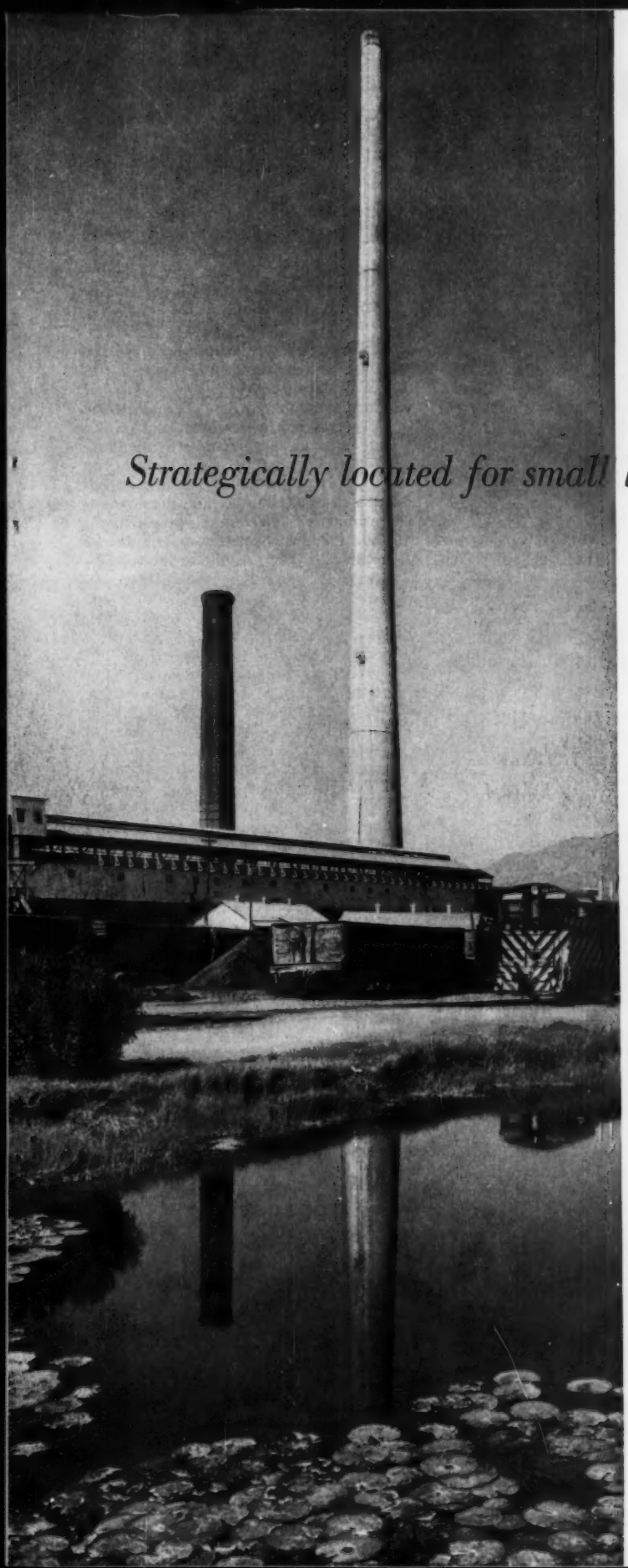
Major expenditure will be on the opening up of the deeper areas of the mine. Both the Far East and South-East subvertical shafts will be sunk to a depth of 9,000 ft. In addition, extensions will have to be made to the incline shafts and to the ventilating, cooling and pumping systems.

High-speed off-reef development has recently been started westwards from No. 2 Shaft at Harmony in the Orange Free State. The idea is to establish stopes in that area as soon as possible.

With the commencement of hoisting at No. 2 Shaft there has been a steady build-up in the scale of operations which is expected to continue until mid-1959. Thereafter the usual seasonal decline in the non-European labour supply may be expected to prevent any further build-up for the remainder of the year.

Behind the announcement that the Western Deep Levels mine is to raise another £4,750,000 ($13.3-million) of additional working capital is a story of rapid progress in operations. Western Deep, in the area west of Johannesburg, was formed in late 1957. It was then considered that the first year would be devoted mainly to planning and work preparatory to shaft sinking within the mining lease area and that the sinking of the first shaft would follow at the end of that year, followed by the sinking at intervals of three further shafts.

Progress achieved made it possible for sinking to begin in the No. 3 ventilation shaft within six months of the incorporation of the company and for the sinking of the No. 3 main and No. 2 ventilation shafts before the end of June, 1958.



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Copper *(Continued)*

don had reached about 24¾c and the European spot market had premiums that put it well over the U.S. producer price. The good smelter sales in the U.S. permitted them to close the gap there, and on June 10 they quoted 25c delivered; the next day some were at 26c. Part of the U.S. strength reflected the view the Government would do something for the copper companies.

Subsidies were proposed by Interior Department Secretary Seaton, May 23 in the form of a bill. It was seen immediately that if it were passed the copper companies would benefit. But it would mean a payment by the Government of a differential to bring up to 27½c the sum of the amount obtained on the market and the Government payment. Market prices might not be raised by this and could be reduced. The Administration withdrew the subsidy proposal and substituted in early June a 150,000 ton stockpile plan at 27½c per lb. Many companies favor one-shot measures when industrial conditions are unprofitable, because the Government does not then have a continuing active part in affairs of the industry. With import duties, subsidies, quotas, tax abatements and international agreements, the Government is always involved and there is always a possibility it will demand restrictive committments from industry. In the 1953-1954 recession, the U.S. Government bought 100,000 tons of copper from the two Chilean companies.

In April the U.S. Administration had indicated it would not support extension of the suspension of the U.S. import duty. It became evident that on July 1, 1958 a 1.7c import duty would go into effect and the conditions would appear permitting U.S. producers to raise prices. This would tend to have no upward effect on prices outside the U.S. and could be price depressing. But the 150,000 tons stockpile proposal, by taking off the market much of the world surplus, would firm prices everywhere. A number of announcements of additional output cuts had been made. Kennecott had indicated it would cut perhaps 40,000 tons or more, annual rate, in early May. Late in May Phelps Dodge said it would cut about 42,000 tons annual rate and Anaconda said later in May it would make a small cut in Montana.

The stockpiling plan, the sharp output cuts expected and the certainty the U.S. would have a 1.7c import duty July 1 set the stage for action. Following the U.S. smelter increase to 26c and the rise in Europe to above

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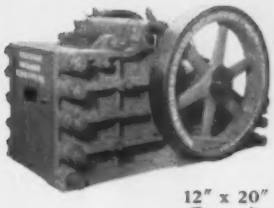

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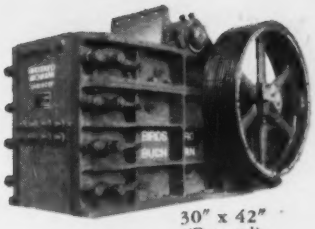

30″ x 42″
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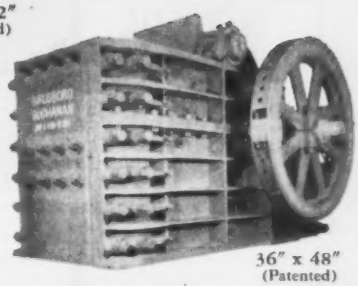

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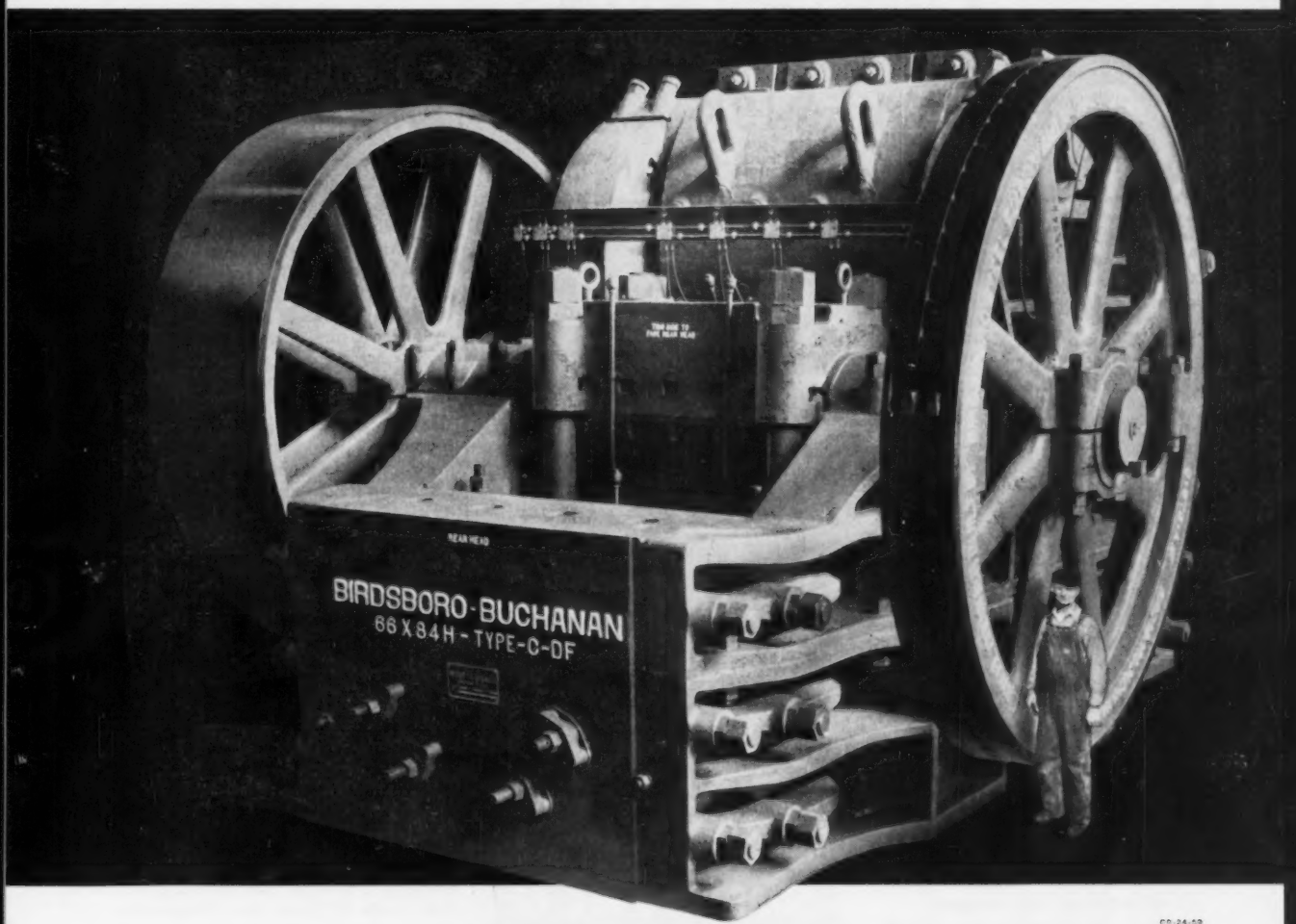

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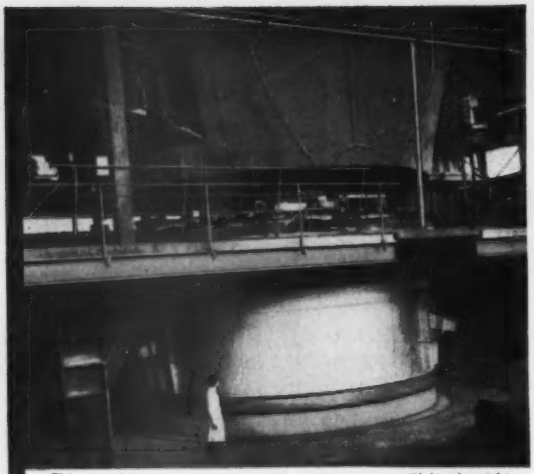

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Copper (*Continued*)

the U.S. 25c producer price, Anaconda announced that effective June 17 its price would be 26½c delivered. Phelps Dodge waited until July 2 to follow. Kennecott stuck to 25c until July 17, exactly one month after the Anaconda move. One might assume it was one of the firms which most vigorously advocated the free competitive enterprise system. Its low cost, and possibly a desire to reduce inventories may also have been instrumental in remaining at 25c.

With the July 17 copper price rise to 26½c by Kennecott, the actual price for fabricated products went up a corresponding amount in the U.S.

The U.S. weighted average price rose slightly following the Anaconda move and a little more after Phelps Dodge raised. July 17 it reached 26.-000 f.o.b. By July 18 all U.S. custom smelters and producers were at 26½c delivered. Prices rose in Europe throughout July and at the end of the month were about equal to U.S. prices. Indications that the U.S. economy was recovering helped.

Government action had some effect on copper markets. The U.S. Government proposals provided a psychological stimulus. Some sections of industry sought Government entrance into industry problems, but Congress rejected the major proposals. The import duty provided a real stimulus in the U.S. The U.K. Government arranged to sell its 30,000 ton stockpile over a ten month period in 1959. It had at the beginning of 1958 rescinded its earlier announcement that it would sell 27,00 tons. Major incentive for its sales have been largely financial — such sales could contribute to improving its international balance of payments. They had improved greatly by January 1959, but the Government evidently believed the improved situation in copper would permit gradual sales without a disastrous effect on the market.

The Coordinating Committee (COCOM) of NATO reduced restrictions on exports to the Iron Curtain countries. Sales of unmanufactured copper were then made to the USSR —wire sales under 6mm diameter had been permitted and may be reduced.

Increased output was first announced by Kennecott. Early in August 1958 it said it would raise operations from four days to five days a week in the U.S. This meant about 48,000 tons per year—less than a 20% increase. Some rumored that the move was to discourage Congress from passing copper legislation. These rumors were doubted by analysts who felt

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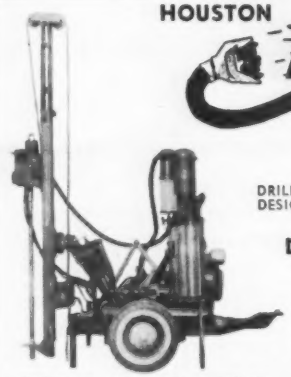

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Copper (*Continued*)

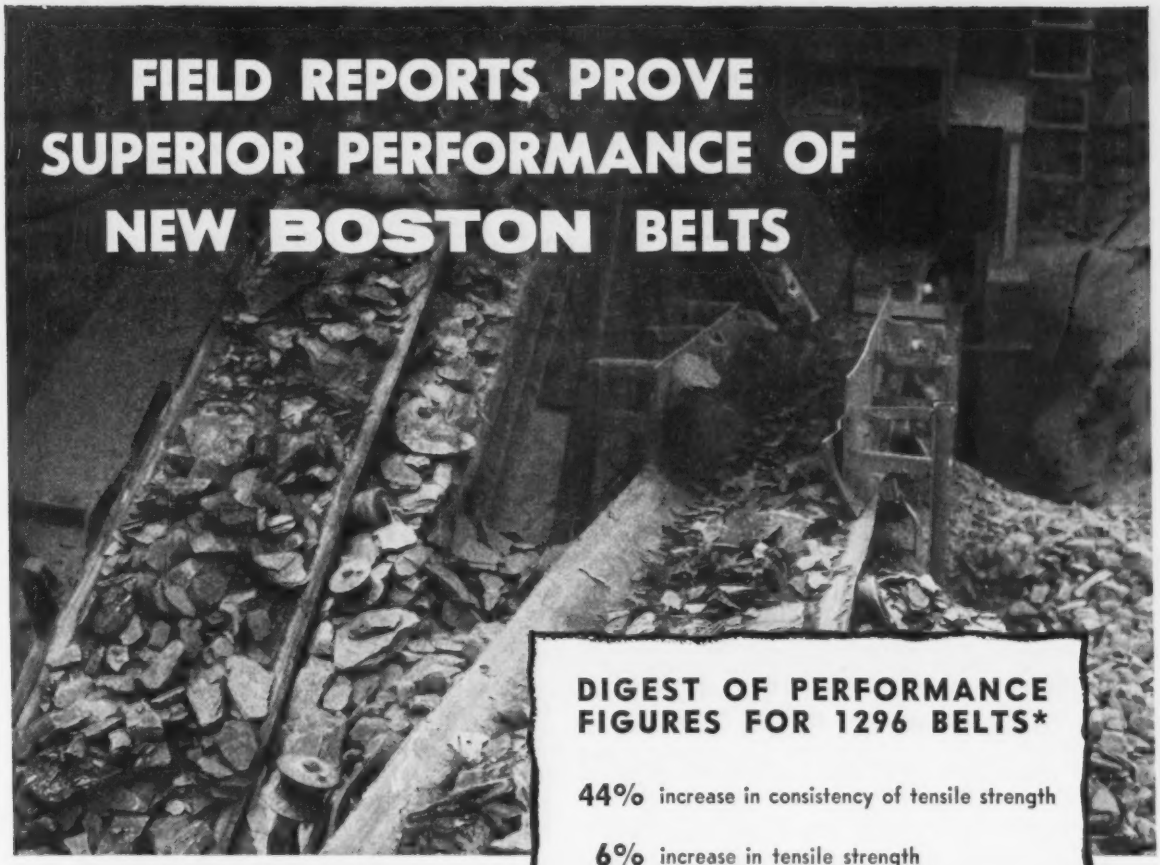
Kennecott had sold heavily when it maintained the 25c price longer than others. Fabricators reported the company was genuinely concerned about its low inventories. This became more evident about Aug. 20 when it was indicated it would raise to a six day operating rate; later it said it would go to seven days. Phelps Dodge announced it would go to five days early in September. By late October it appeared Kennecott's total increase would be about 13,800 tpm and Phelps Dodge about 3,400 tpm. No information was released on possible increases by Anaconda.

The Bancroft mine in Rhodesia will begin producing April and will be at an annual rate of 50,000 tons. Katanga is also raising output.

The U.S. producer price of 29c at the beginning of 1959 was the central fact in all copper markets (except perhaps Australian). Producers had raised to 27½c Oct. 13 and 14th and to 29c Oct. 23 and 24. It was widely believed that if a balance were achieved in demand and supply, Europe would be less than the U.S. producer price by about the amount of the import duty, 1.7c. Cost of shipping to the two areas is not greatly different from Chile and Africa. When Europe is close to 28c, sellers in the U.S. will make more by exporting copper produced from imported material. Copper made from imported ore, sold in the U.S. at 29c delivered, gives the seller a return of about 26.9c after paying about 0.4c internal freight and 1.7c import duty. At 28c in Europe the seller gets about 27c after paying freight from the U.S. With good economic conditions in the U.S. it must be a net importer of copper. The movement of this copper should be a balancing factor in world copper prices. Many analysts believe if U.S. producers raised to 30c or 31c all other prices would adjust to it. But as prices rose, more copper would be produced, putting limits on price increases. When the U.S. price reached 27½c some copper deliverable to the U.S. Government entered commercial trade and in December only about 200 tons of the perhaps 11,000 tons eligible went to the stockpile. Though about 80,000 tons could be delivered to the U.S. stockpile in 1959, at present prices it is even possible none will be delivered.

Labor - management contracts end this summer. Nearly all copper mining and refining properties in the U.S. are on a three year contract that ends June 30 for most firms; some are 30 and 60 days later. Most contracts are with Mine-Mill though the steel union

FIELD REPORTS PROVE SUPERIOR PERFORMANCE OF NEW BOSTON BELTS



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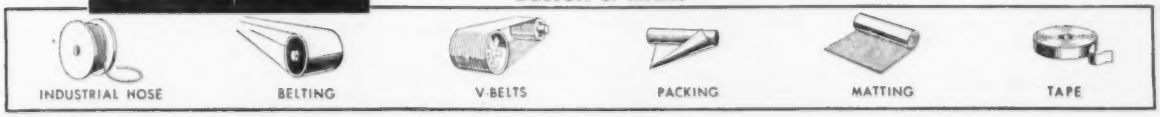

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Copper (*Continued*)

and chemical union also have some. Some officials of copper firms predict wide discrepancies in the position of management from the unions and suggest strikes may result. Others feel both sides recognize the heavy losses from strikes and suggest settlement may be prompt. Many producers and fabricators may endeavor to go into the summer with sizable stocks. If prolonged strikes do occur, pressure on prices may be strong but producers may hold them to 36c or under. Contracts also end in Chile this year•

PERSONALS

Brigadier Donald Gordon Farquharson, C.B.E., vice president and administrative manager of Kaiser Bauxite Ltd., Jamaica, has been appointed a member of the Jamaican Legislative Council to fill the vacancy created by the recent death of **C. V. Helwig.**

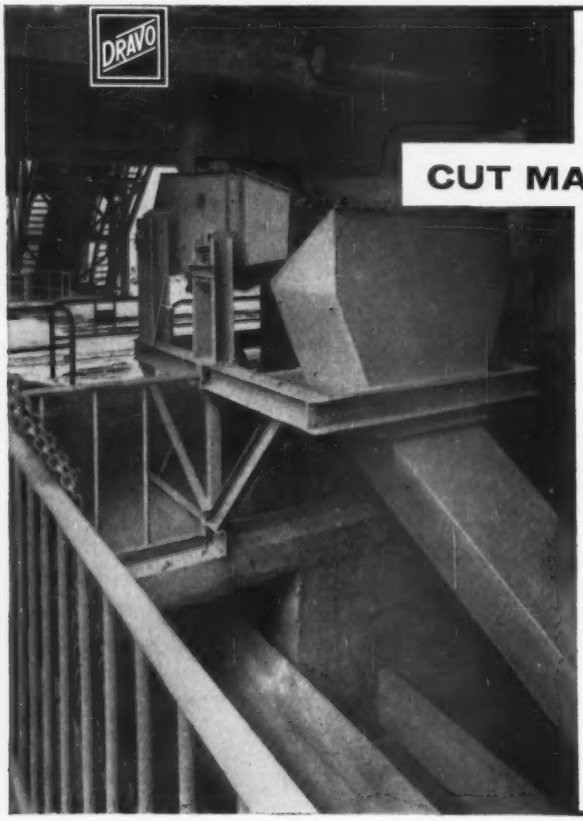
John Parden was recently appointed assistant superintendent of maintenance of Oliver Iron Mining Division's Eastern district. **Bill Bush** was appointed operating engineer and **Bob Graham** was made industrial engineer.

Oswood G. MacDonald has been elected president of the newly incorporated Cellardor Mines Ltd. On the board of directors are: **David Whiting,** vice president; **John C. Cowan,** secretary-treasurer; **Robert C. Smith,** assistant secretary; and **Norman Skidmore. B. W. W. McDougall** is consulting engineer.

J. S. Collbran, Jr., will serve as manager of New Jersey Zinc Co.'s newly organized Pacific district sales office, with headquarters in Los Angeles. He was formerly the western district sales manager in Chicago. **James P. Sheridan,** pigment sales manager since 1954, has become the new western district sales manager.

Chester M. F. Peters, mining geologist on assignement with the Paul Weil Co., returned to New York recently to continue his consulting practice.

Dr. William A. Bain Jr., formerly vice president of Vitro Laboratories and director of Vitro's West Orange Laboratory, has been named executive vice president of Vitro Laboratories with offices at Silver Spring, Md. **Arthur S. Locke,** formerly associate director, succeeds Bain as director of the West Orange Labs, and **Dr. Lewis H. Rogers,** senior chemist at the Air Pollution Foundation, Los Angeles, has been named associate director of the laboratory to succeed Locke.



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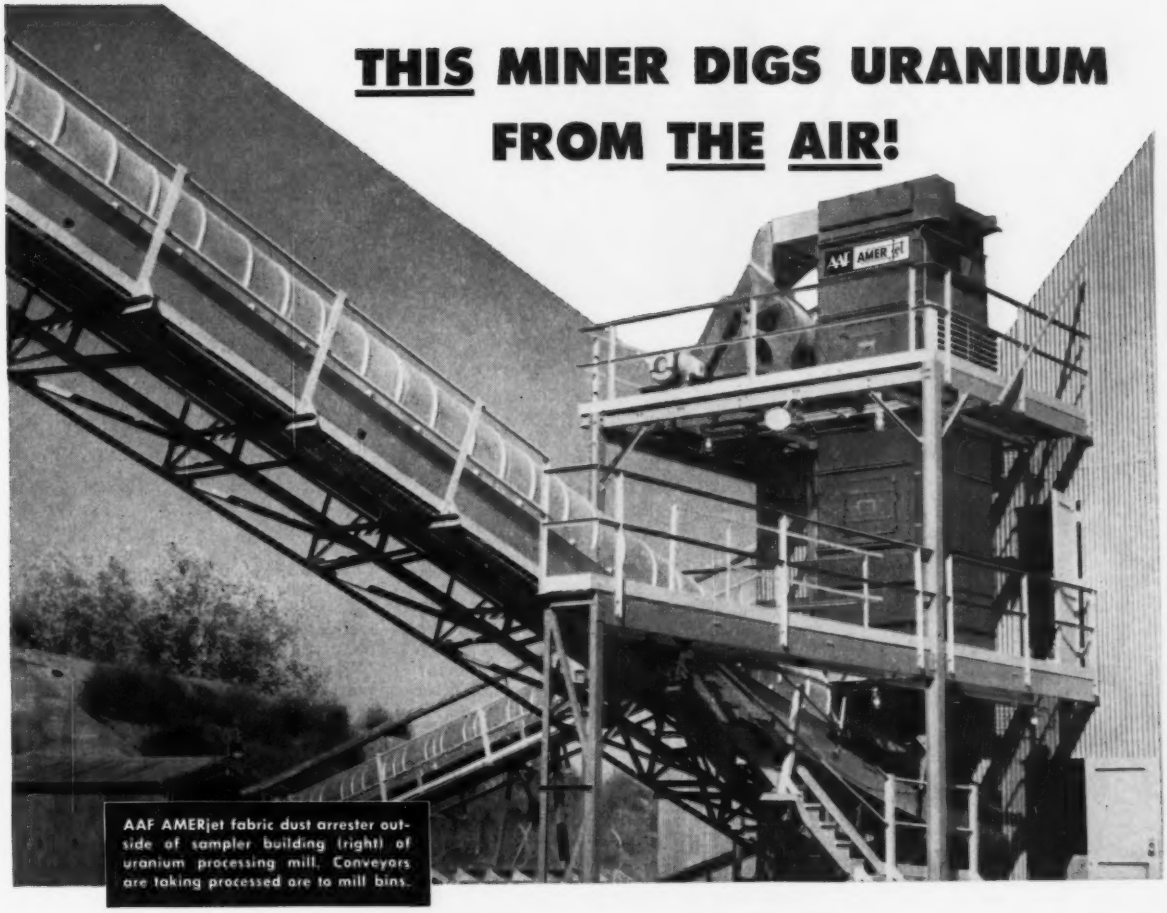

AAF AMERjet fabric dust arrester outside of sampler building (right) of uranium processing mill. Conveyors are taking processed ore to mill bins.

AAF AMERjet salvages valuable dust at uranium processing mill

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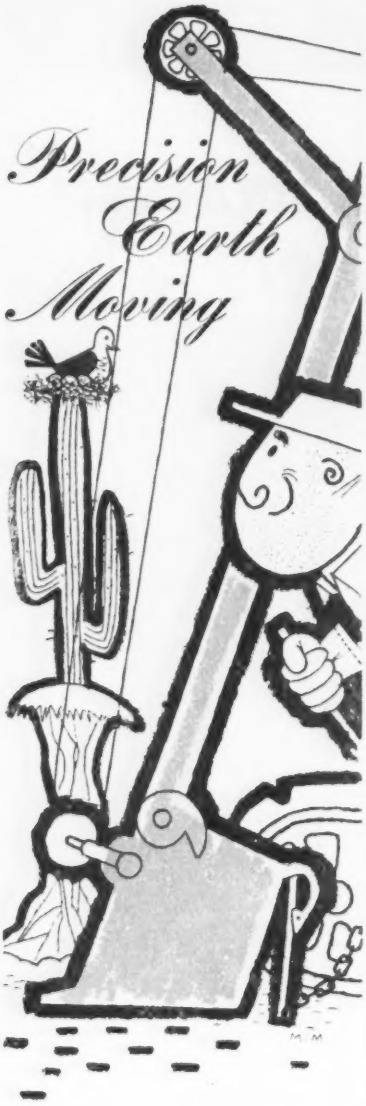

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PUBLICATION of the Minerals Yearbook, by USBM, has been accelerated in recent months. Among the prime movers were Paul F. Yopes, assistant to the chief, Division of Minerals (left), and Mrs. Kathleen D'Amico and her staff of statisticians.

USBM Speed Up Minerals Yearbook Output

OFFICIALS of the U.S. Bureau of Mines are taking a justifiable pride in the recent accomplishments of the Division of Minerals, headed by Charles W. Merrill, which has been conducting a "speed-up" of the production of the Minerals Yearbook, USBM's annual record of the performance of the mining industry.

Thanks to the efforts of the Division staff in Washington and in the field, and to Mr. Merrill, Paul F. Yopes, assistant to the chief, and Mrs. Kathleen J. D'Amico, of the statistics section, publication of the yearbook is now "within shouting distance" of the year stamped in gold on its cover.

Since 1954, the Bureau's Minerals Division has been working to get better statistics and interpretive evaluations of technical data on metal and mineral mining and processing in the U.S. and abroad. Tapping and processing vast loads of informational material, USBM staffers have found, is about as tough a job as extracting and refining the raw materials themselves.

What's been accomplished so far is this: The 1956 yearbook on metals and minerals—one of three volumes, the others covering fuels and geographical area reports—came out last August. In the past year, all three volumes for each of the years 1954-1956 were published. In addition to the yearbooks, monthly and yearly summaries of domestic production alone have been hurried without sacrificing completeness, and other factbooks are planned.

The Government Printing Office finished the 1957 volume in January and it is already in the hands of its readers. Future goals are even more ambitious. By year-end, USBM plans to be on a new schedule which calls for publication of all annual volumes by December of the following year. After that, the goal is to get yearly editions out even earlier, possibly by mid- or late summer.

Since 1952, Bureau field offices have taken over an increasing share of actual collection and evaluation of domestic statistics, and the foreign activities division has been expanded to provide a better check on overseas mining, even behind the Iron Curtain. Technology sections have been added. Members of the staff recently received awards for the speed-up.

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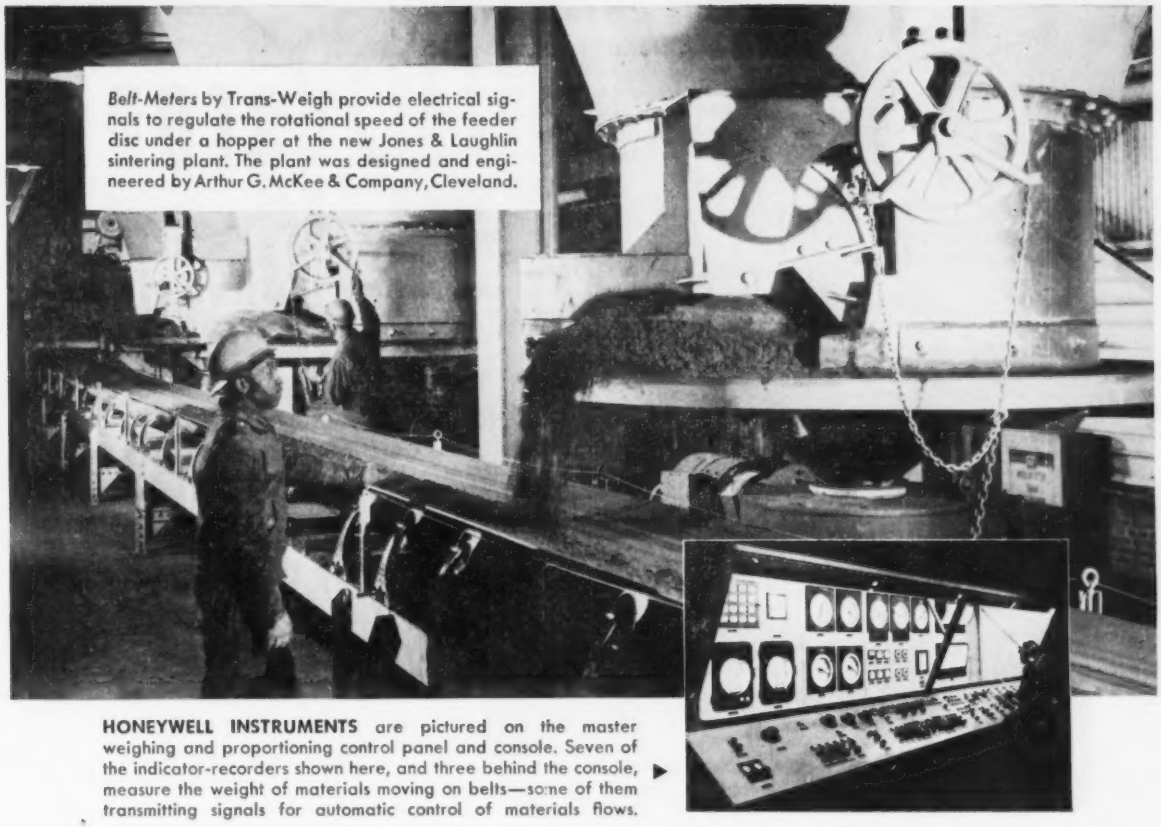

Belt-Meters by Trans-Weigh provide electrical signals to regulate the rotational speed of the feeder disc under a hopper at the new Jones & Laughlin sintering plant. The plant was designed and engineered by Arthur G. McKee & Company, Cleveland.

HONEYWELL INSTRUMENTS are pictured on the master weighing and proportioning control panel and console. Seven of the indicator-recorders shown here, and three behind the console, measure the weight of materials moving on belts—some of them transmitting signals for automatic control of materials flows. ▶

Sinter mix automatically weighed and proportioned at Jones & Laughlin plant

Honeywell *instruments control continuous process*

There's no time out for weighing materials at Jones & Laughlin Steel Corporation's 2,500 ton-per-day sintering plant in Cleveland. An automatic system weighs iron ore fines, coke breeze and flue dust, and feeds them in exactly right amounts to the sintering machine. The *Belt-Meter*® system, supplied by Trans-Weigh Company, King of Prussia, Pa., features a continuous electrical weighing technique and uses Honeywell instruments to control and proportion flow rates of materials as they move along a short section of belt.

The system consists of three main parts: (1) an electric tachometer to measure belt speed, (2) an electric strain gage load cell to measure belt load, and (3) an *ElectroniK* potentiometer to indicate and record flow of materials in tons per hour. In addition, a magnetic amplifier controls flows from table feeders. Twelve automated weighing units check materials as they move through every important phase of the sintering process. Operators can vary ratios and switch to manual control when desired.

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Personals *(Continued)*

Arthur T. Newell has retired as works manager of the Stauffer Chemical Co.'s plant at Henderson, Nev., but will continue as a consultant to local management. A mining engineering graduate of the University of Wisconsin, class of 1915, Newell started his career at Anaconda's smelter in Montana, in engineering and supervisory capacities.

R. S. Walker, Cleveland, consulting engineer for the M. A. Hanna Co., retired after 50 years with the company. In 1910-12, he was superintendent of the American mine near Ishpeming, Michigan. From 1912 to 1917, he was in Duluth as chief engineer, after which he was transferred to the Cleveland office as consulting engineer for all the M. A. Hanna operations.

Charles Coole has been appointed mining captain at North Range Mining Co.'s Champion mine at Champion, Mich. He succeeds **Bryan Farragh** who has been made surface foreman.

Gilbert R. Semans has been appointed chief steel metallurgist of A. M. Byers Co., Pittsburgh. Before joining Byers, Mr. Semans was director of metallurgy at Jessop Steel Co., research associate and director of the metallurgical laboratory at Universal-Cyclops Steel Corp., and was also employed by Kennametal Inc.

Mercer Brugler was elected chairman of the board of Pfaudler Permutit Inc. and **Donald A. Gaudion** was elected president of the company at a recent board of directors meeting in Rochester, N. Y. The board also approved the appointment of **C. Wendell Beck** as general manager of Pfaudler Div. succeeding Gaudion.

The company's present chairman, **H. W. Foulds,** retired on the first of this year but will retain a membership on the board. He had been president of the Permutit Co. since 1944 and, when it recently merged into Pfaulder Permutit Inc., became chairman of the board.

Gaudion, 45, a graduate of the University of Rochester and the Harvard Graduate School of Business Administration, joined Pfaudler in 1948 as assistant to the president. Elected to the board of directors in 1951, he became vice president in charge of sales and advertising in 1952 and was named executive vice president in 1955.

Merlyn G. Woodle became manager of the Babbitt Div. of Reserve Mining Co. on Jan. 7. At the company's Silver Bay Div., manager E. C. Lampman announced two new appointments: **James A. Reynolds** as superintendent of the crushing and concentrating department, and **William P. Pearson** as assistant superintendent of the same department.

Lew Adamac, mining engineer, has become general manager of Afra Mines, Morocco.

Charles F. Skinner has been named vice president and general manager of Western-Knapp Engineering Co.

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(2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve

(4) through which oil is injected into the air stream.

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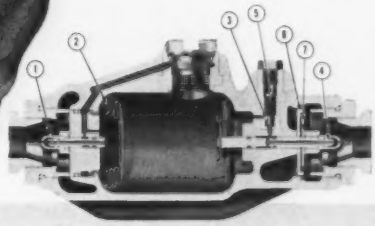

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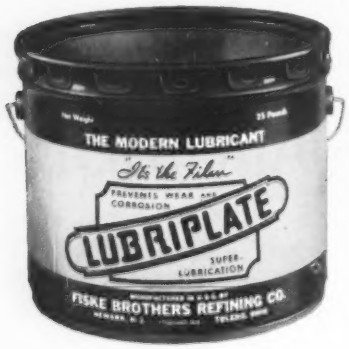

OBITUARIES

James E. Moore, mining engineer, died at San Leandro, Calif. on December 10 after a long illness.

Henry Krumb, 83, mining engineer and former trustee of Columbia University, died in New York on Dec. 27.

He was best known for his examination of mines producing the "porphry coppers".

Roy E. O'Brien, 60, first western secretary of the AIME, died Jan. 9 at Salt Lake City.

LETTERS

We regret to advise that the article "Research Team Studies Nephaline Syenite" (E&MJ, Nov 1958, p 140) is inaccurate in content.

No current or past tests have been undertaken at the Engineering Experiment Station to process to a low iron level the nepheline syenites occurring in the United States. Studies of this type have been undertaken by the U.S. Geological Survey, Rutgers University, the University of Arkansas and others. It has not been found possible, to date, to process these rocks to low enough iron levels suitable for general application in ceramics.

The Ohio State University project to find new or improved applications of nepheline syenite in ceramics is jointly sponsored by American Nepheline Ltd. and the Great Lakes Foundry Sand Co., Detroit, Michigan.

C. J. Koenig, Professor
Ceramic Engineering

I want to pay this tribute to my friend and mining associate, Flaudio Griego, who died on Oct. 27th, 1958. Without any formal training in mining, lacking even a high-school education, Flaudio, in seven years' time (1950-1957) produced the greatest beryl output ever recorded from a single mine in North America. He did it with a minimum of mining equipment, and with never more than two to four helpers. And he succeeded where most experienced mining men might have failed —by the very simplicity of all he did: by meeting every mining problem with the tools and materials at hand; and by improvising his own practical methods on the spur of the moment.

Flaudio, only 52 when he died, was a Spanish-American citizen of Dixon, New Mexico. He began his mining career with me in 1943, when I began small-scale operations for tantalum minerals in the Harding pegmatite deposit near Dixon. His resourcefulness, dependability, initiative and never-failing good humor immediately set him apart from the other miners. In 1949, after the mine had been shut down for a short period, Flaudio wanted to do some more mining. I offered him an equal partnership in a beryl operation at the Harding, provided he would run the mining end himself. It was a complete gamble, despite favorable indications from a Bureau of Mines drill hole, and first off, it would be necessary to drive a

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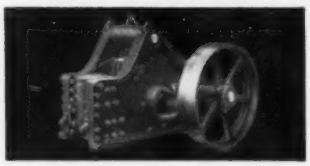
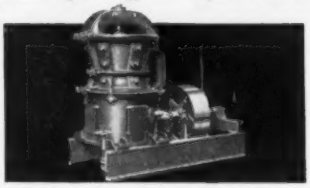
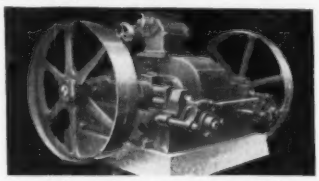


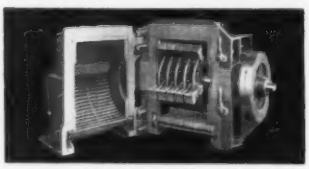
Jaw Crushers — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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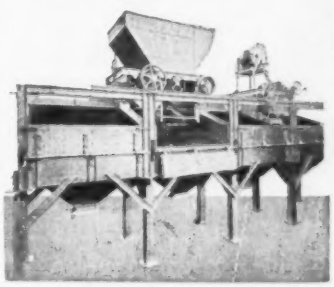

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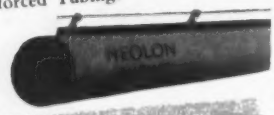

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Letters *(Continued)*

tunnel 150 ft under slabby schist.

Flaudio ran the tunnel with the help of one man. For 70 ft nothing showed up except a few scattered fist-size spots of beryl close to the top of the horizontally-disposed pegmatite. Beyond 70 ft the pegmatite bulged upward, and before he knew it he had blasted right into an immense mass of white beryl.

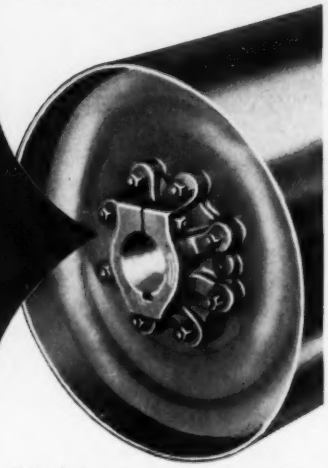
From that time (early 1950) until late in 1957 when he fell critically ill, Flaudio mined beryl as no other person has ever mined it. He did it in his own way, forever following the devious ore, breaking it out in big chunks, hand-sorting it from white feldspar and quartz. From 1950 to 1956 the operation shipped 600 tons of high-grade beryl (11% BeO) to the national stockpile plus 184 tons of low-grade beryl ore (6% BeO) shipped elsewhere. This amounted to 20% of the entire U.S. beryl production during that period. No other beryl mine in this country has ever begun to approach such a record.

The success of the operation depended as much on Flaudio's short-cut methods and economies as on the high yield of rich ore. When a rented air hoist for the incline proved too expensive and cumbersome, he purchased a mule for $12.00, which gave an enormous saving at improved mule-power efficiency. When mining engineer friends advised a costly set-up for starting the tunnel entrance through badly caved ground. Flaudio ignored the advice and did the job his own way in a much more primitive, but for cheaper and more effective fashion. He designed his own brand of ore chutes, ore bin, and loading platforms. To haul the mine car out of a new tunnel run at a much steeper incline, Flaudio attached a cable from the car to his truck out in the quarry, which on backing up 100 ft pulled the car up the incline with ease and speed. His skill at improvising simple practical solutions to unexpected emergencies was never better proven than the day a big loaded trailer truck slipped off the mine road, when sideways down a muddy slope, and lay dangerously tilted over at an angle of about 40 degrees. Mining engineers with cables, jeeps and trucks failed to budge it. Flaudio finally set to work with four men and a series of small jacks and wood blocks. Inch by inch the trailer was righted, until the driver could at last climb inside and run it down the slope to level ground.

Advantages of education, technical skill, and engineering training were never so important as they are in this day and age, yet Flaudio's story, proving the resources of an untutored, but keenly practical mind tells us that other equally essential factors must still be reckoned with. Machinery and mechanized methods won't solve everything—for these cannot ever take the place of the ingenuity and infinite resourcefulness of a human being. The mining achievements and the shining example of Flaudio Greigo will not be forgotten.

Arthur Montgomery
Harding Mine

AMERICAN conveyor pulleys give you job-rated capacity for your toughest conveyor applications



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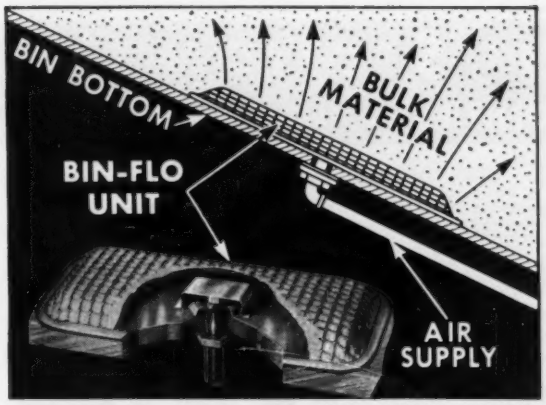

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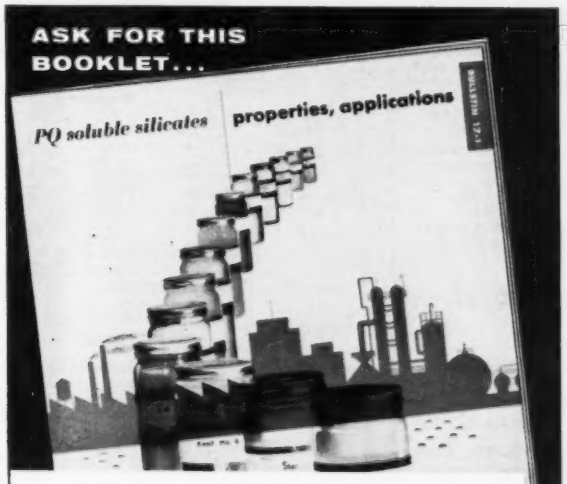

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2—6 ton General Electric Locomotives
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3—8 ton Ironton Locomotives
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1—25-HP Vulcan #1½
1—30-HP Vulcan #22C
2—40-HP Vulcan
1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
1—100-HP W. A. Box
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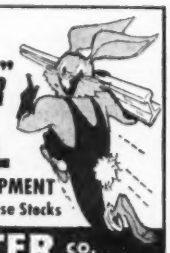

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24"	45'	2430	1330	21.78
24"	100'	4740	2514	21.78
24"	150'	6840	3603	21.78
30"	70'	3871	2119	24.75
30"	90'	4831	2614	24.75
30"	100'	5311	2862	24.75
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6—TM7 Coppus Ventair, 10 HP, 220/440 V
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1—625 cfm Ingersoll-Rand, XCB, 125 HP, 2200 V
1—1000 cfm Chicago Pneumatic, OCB, 200 HP, 440 V
1—1050 cfm Gardner-Denver, HA, 200 HP, 2200 V
1—1500 cfm Worthington, 300 HP West. Syn. 2200V
1—2000 cfm Worthington, 400 HP GE Syn. 2300 V
1—2500 cfm Sullivan, WN4 400 HP West. 2200 V

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4—HKE Gardner-Denver, 2 drum, Air

84 cu. ft. Mine Ore Cars

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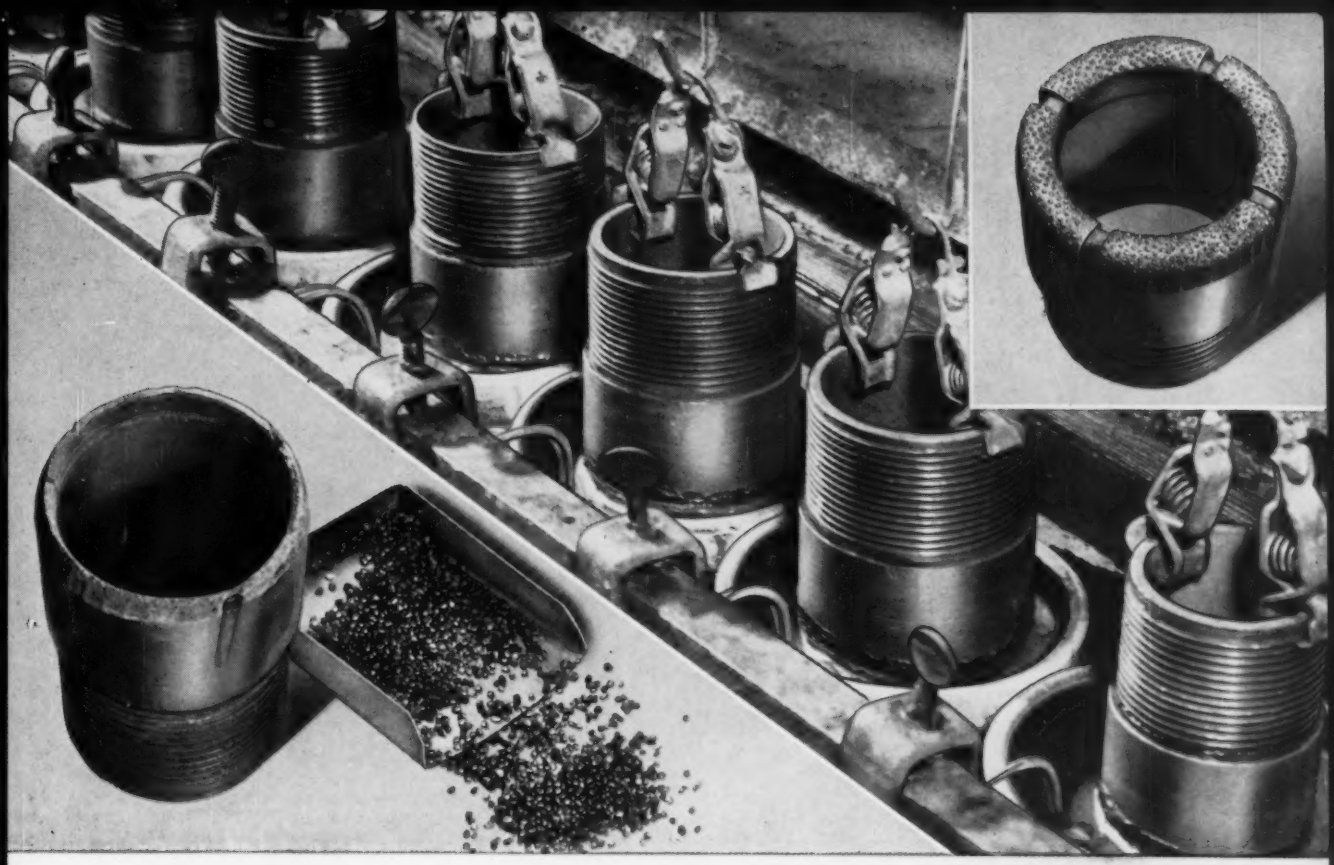

HIGH salvage—a built-in "extra" in every Truco Bit

The scoop of diamonds in the foreground represents one of the important sources of savings when you use Truco Bits—salvage, *high* salvage.

High salvage had its first beginning many years ago when Truco engineers developed the remarkable matrix metal in which Truco diamonds are held in a chemical as well as physical bond. The tenacity of this bond greatly reduced diamond loss, kept more diamonds cutting longer and deeper and yielded more salvage.

Getting the salvable diamonds out of this matrix without damaging them was the next problem and it was solved by Truco engineers developing a process in which the matrix metal is dispersed by electro-chemical action and the diamonds are released. When perfected, this process was adopted by the entire industry.

Above, right: a new three-inch bit ready for use. Center: a bank of salvage tanks in which used bits are being processed. Below, left: a used three-inch bit after the salvage process and salvaged diamonds which will be reset "best face to the work" as always in Truco Bits. Thus, through high salvage and expert resetting, the diamonds in your Truco Bits give you additional footage and additional economies which can be an important factor in reducing your operating costs. Try a Truco and see for yourself.

TRUCO DIAMOND BITS *by*

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.

575 Langlois Avenue, Windsor, Ont., Canada

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TIME and time again, machinery makers come to the Timken Company for help with some special bearing application problem. One they think hasn't been solved before. And time after time, from our 30 types and 10,247 sizes of Timken® tapered roller bearings, we've come up with the bearing design to do the job and at minimum cost.

It's no accident that we can help out so often. In sixty years of helping machinery builders with bearing problems, we've engineered and produced the world's largest selection of tapered roller bearings. And we've constantly improved our designs. The answers to thousands of bearing application problems are already in our files. Ready and available to help you.

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